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ORIGINAL MEMOIRS.

TRAUMATIC ERB'S PARALYSIS IN THE ADULT.*

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THE occurrence of traumatic Erb's paralysis in adults is so frequent and the menace to the future utility of the extremity is so great as to justify a discussion of the subject before this Society.

In all essential features these adult cases are exact counterparts of the brachial birth palsies of Erb's type.

These paralyses are practically always caused by the forcible separation of the shoulder from the head and neck. The more suddenly the force is applied, the more likely are the roots to be torn across instead of simply stretched and frayed. There are many ways in which this separation occurs, but a few illustrations will suffice. One patient fell from the top of a freight car, striking simultaneously upon his head and shoulder with resulting sudden forcible separation of the two. Another, when his bale hook slipped, did a half somersault backward, landing on his head and shoulder. Another was caught in a door which was closing by hydraulic pressure. Another was hit on the shoulder by the long starting lever when a big marine gas engine kicked back. A hundred pound

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chain after falling two stories struck on the shoulder of an ironworker.

Reference to the anatomical relations of the cervical spine, the shoulder, and the roots of the plexus as they run obliquely across the base of the neck makes it evident that in these forcible separations the strain first comes upon the upper roots of the plexus, then, as they give way, upon the next lower roots, and so on until the entire plexus is ruptured.

Before the nerve-roots themselves give way the deep cervical fascia which lies just in front of them tears, the nerve sheaths rupture, and finally the nerves themselves yield. Combined with these torn fibrous and nerve tissues is the blood-clot resulting from the injured vessels. After a time these elements organize into a cicatrix which prevents the passage of nerve impulses and the regeneration of the nerve fibres.

This cicatrix may involve only a part of the upper root, may involve the entire plexus, or may stop at any point between these two extremes. There may be several cicatrices scattered about the roots.

One or more of the roots may be entirely torn across, the ends dislocated and firmly adherent by cicatricial tissue to neighboring structures. The cicatrices may run well up into the intervertebral foramina, or in certain cases the roots may be torn from the cord itself.

As previously stated, the injury in these cases practically always involves the roots in order from above downward, so that the major effect is in the upper roots and shades off in those below, unless the traumatism has been sufficient to rupture the entire plexus.

The paralyzed muscles fall naturally into groups which correspond with their dependence upon individual nerve-roots for their innervation.

The majority of cases fall into the "upper arm type" in which the fifth and sixth roots are involved. The supra- and infraspinati, the deltoid, the biceps, the brachialis anticus, and the supinators are completely paralyzed, while the pectoralis major is only partly paralyzed because some of its

innervation comes from the lower roots of the plexus. There is lost the power of abduction and external rotation at the shoulder, flexion at the elbow, and supination of the forearm, so that the unopposed action of the antagonists causes inward rotation of the arm and pronation of the forearm which gives the characteristic attitude to these paralyzed extremities.

When the injury involves the lower roots there is lost the power to move the wrist, the fingers, and the intrinsic muscles of the hand.

If, as occasionally happens, the damage to the roots occurs close to or within the intervertebral foramina, the nerves running to the serratus magnus, the rhomboids, etc., are injured and wing scapula results.

Occasionally the roots are torn from the cord itself. The resulting superficial scar formation on the surface of the cord may later cause changes in the reflexes or the appearance of the Babinski phenomenon in the corresponding lower extremity.

The muscles which are totally paralyzed become flaccid, show the complete reaction of degeneration (R. D.) (five to seven days), and soon begin to atrophy. Because of such changes in its surrounding muscles the shoulder-joint usually becomes a typical flail-joint.

Other muscles show varying degrees of sluggishness in their reaction to electrical stimuli.

The muscle reflexes are diminished or lost, and there is a decided loss of muscle tone.

Sensory disturbances are less definite and less extensive than the paralyses. The area of sensory disturbances depends somewhat on the extent to which neighboring sound sensory nerves overlap on the field of distribution of the damaged ones. Usually the upper outer region of the arm (the deltoid region) shows the most definite changes. A central area of complete anæsthesia is apt to be surrounded by a border of diminished sensibility which shades off to normal at the periphery.

The areas of disturbance are not co-extensive for the different forms of sensory stimuli (see Figs. 9, 10, 11, and 12).

The sense of deep touch is least apt to be affected. Light touch perception begins to return before that of pain and temperature.

In all of these cases for many months palpation in the region of the sixth cervical transverse process will demonstrate a tender indurated mass which is the cicatrix resulting from the torn deep fascia, nerves, and blood-vessels.

In a certain few cases where the two lower roots are damaged there is an associated injury of the cervical sympathetic (see Case VI).

The course followed by these cases is fairly characteristic. When there has been complete rupture of all the roots there will be permanent paralysis of all the muscles, permanent sensory changes, R. D., marked flaccidity, and atrophy.

When there has been less than complete rupture improvement will always appear after a time, usually three months. In these cases, as the injury occurs from above downward, the lower roots are naturally least injured and therefore show regenerative power first. For this reason the improvement always begins below and progresses upward toward the shoulder. The deltoid and spinati are the last to show results.

Sensory disturbances improve much earlier than do the motor symptoms and may entirely disappear while the extremity is still useless.

Response to the faradic current reappears before much change in the galvanic polarity is noticeable and before voluntary motion is perceptible.

Finally voluntary power reappears in the lowest group of paralyzed muscles, and slowly progresses upward until it has reached the muscle groups innervated by the nerves, which have been so injured that firm cicatrices have formed and prevent nerve regeneration. Here progress ceases. This slowly progressive improvement may cover a period of two years and then the residue of permanent paralysis still be crippling in extent.

The prognosis, without operation, is distinctly bad. In five out of the six cases included in this paper lesions were

found which would inevitably have caused permanent paralysis of crippling extent. Nothing short of surgical intervention could have overcome the obstruction to the passage of nerve impulses.

With proper surgical interference the prognosis is immensely improved, but even so, a perfectly functionating extremity can be expected in only a very small percentage of cases.

Certain factors influence the prognosis in any given case:

In general, the longer the time elapsed between the injury and its surgical repair the less perfect will be the regeneration. Nevertheless many cases are on record in which, after years have elapsed, repair has been followed by very satisfactory improvement.

The more extensive the lesion, the less favorable the prognosis, but the more imperative is it to interfere and repair the damage as far as possible.

When the cicatrix extends into the intervertebral foramina the outlook for regeneration is bad and it may be necessary to anastomose the distal trunks into other roots.

When the roots are torn from the cord, anastomosis is the only resource which gives any hope.

Accurate approximation at the time of suture, prolonged immobilization with the shoulder and neck in close proximity, and systematic persistent after-treatment very greatly favor the final success in these cases.

The treatment in all these cases should be surgical. The interference should be at the earliest feasible moment. If the tissues at the base of the neck are much contused, a delay for a few days, in order to increase the local resistance, is desirable. Where the paralysis is very slight conservatism might counsel delay in the hope of obtaining spontaneous recovery, but in all cases where the paralysis is at all marked, the time used waiting for spontaneous recovery is wasted.

In paralysis of slight degree, if operation uncovers no macroscopic lesion of the nerve-roots, the wound is closed and no damage has been done to the patient, for this operation

has consisted only in the division of the skin and fat pad at the base of the neck. On the other hand, if some lesion is found, it is corrected at once with the least necessary loss of time to the patient, and at the period most favorable to the regeneration of the nerve-roots involved.

In the third case of the series reported in this paper, while no lesion of the nerve-roots themselves was found, a large indurated mass of tissue lay just in front of them and caused considerable compression. What amounted to a decompression was done, and the result was a very prompt and increasing improvement with a final complete restoration of function in the extremity.

The plexus may be exposed by either of two incisions. One starts just above the insertion of the sternomastoid muscle and passes outward and slightly upward across the base of the neck following the natural wrinkles of the skin. The skin and underlying fat pad are divided in the same line. Usually the external jugular vein, the transversalis colli, and suprascapular vessels are tied and divided. With proper retraction the nerves are pretty well exposed. This wound falls together naturally and heals without any tendency in the scar to spread. Its disadvantage is that in wide-spread damage of the plexus it does not give complete exposure.

The other incision starts at the level of the transverse process of the sixth cervical vertebra and runs obliquely downward and outward to the junction of the outer and middle thirds of the clavicle and divides practically the same structures as in the preceding case (Figs. 1 and 2).

After retraction of the wound in either incision, the deep layer of cervical fascia normally lying just in front of the plexus is found thickened and adherent to the underlying nerves. This is dissected away, thus exposing the roots and plexus which are examined by sight, touch, and, if necessary, by a tiny electrode, to detect the presence of cicatrices which prevent nerve regeneration and the passage of nerve impulses.

The cicatrices are removed by transverse section of the nerves above and below at such levels as expose normal look-

ing nerve bundles in the divided nerve ends. It is sometimes necessary to make several sections before getting a satisfactory looking end. In the distal nerve trunk one can always get a satisfactory looking end by going far enough. In the proximal end, however, the cicatrix sometimes extends up into the intervertebral foramen. These exceptional cases will be considered later.

When the nerves have been properly prepared, end-to-end suture should follow. The best suture material in adults is fine strong silk because it is dependable. On opposite sides of the nerve, about one-half centimetre from its freshened end are passed two sutures transversely to the long axis of the nerve, and including mostly nerve sheath. Each suture is tied so as to get a firm hold and the ends are left long. The other freshened nerve end is treated in similar fashion and the two are approximated by tying the lateral sutures of the one to the other. One or two fine catgut sutures at the periphery will complete the apposition.

Another method of suture which is satisfactory, especially where there is not too much tension, consists in passing a loop of chromic catgut through both nerve ends and tying them together. This is quicker and simpler but has the disadvantage of perforating the nerves as well as not being quite so dependable.

While the nerve sutures are being tied the neck and shoulder are approximated. The fat pad is allowed to fall into place, and the skin wound is sutured with silk. No drainage is used.

The approximation of the neck and shoulder is maintained by means of a steel brace especially designed for these cases and fitted previous to operation so that it can be slipped on just after the nerve sutures have been tied and thus prevent any chance of tearing them out.

This brace is worn continuously, without a moment's intermission, for six to twelve weeks according to the individual case.

In those cases where the cicatrix extends up into the inter-

vertebral foramina, a modified procedure is necessary. The cicatrized root may be split longitudinally up into the foramen, and if good nerve bundles are exposed above, the distal end of the nerve may be sutured into the cleft with the hope that good union will occur. If the split cicatrix does not reveal good bundles above, the only thing left to do is lateral anastomosis of the distal nerve trunk into a neighboring sound root.

In those cases where the roots have been torn from the cord, lateral anastomosis is the only thing to be done.

Where considerable lengths of nerve-roots must be resected to get beyond the cicatrices and the ends cannot be closely approximated, resort must be had to nerve bridging, or the procedure next mentioned.

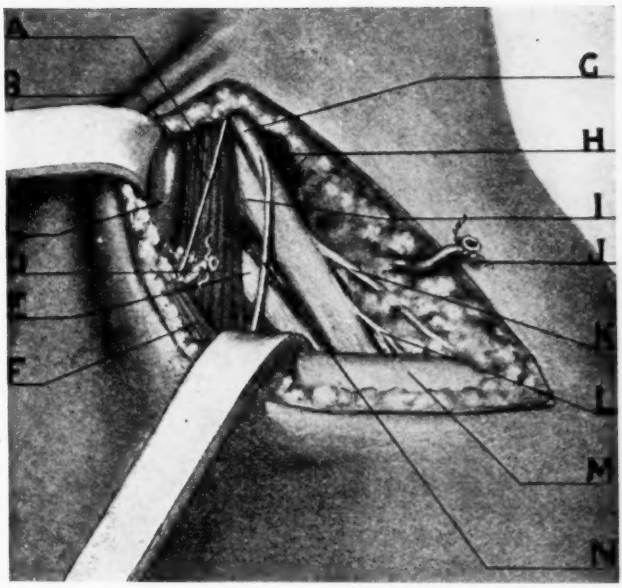
Where the entire plexus is badly torn, and the freshened nerve ends cannot be brought together, a subperiosteal resection of the middle third of the clavicle will permit very greatly increased approximation of the nerve ends. This would greatly increase the chances of regeneration, and certainly an extremity with a damaged clavicle, which will nevertheless move, is very much to be preferred to an anatomically complete extremity which is permanently paralyzed.

When the proper time for the removal of the brace has arrived, the extremity may be placed in an ordinary triangular sling supported by the sound shoulder, and so adjusted as to elevate the paralyzed shoulder. The brace and sling not only prevent the paralyzed extremity from dragging on the nerve suture but also prevent the weight of the extremity from overstretching the paralyzed muscles and thus prolonging their period of inactivity even after nerve repair has occurred.

When the change from brace to sling has been made the extremity may be given massage, passive motion, electricity, etc., every day, being taken from the sling for that purpose. Procedures which would pull the shoulder away from the neck on the operated side should be avoided for many months.

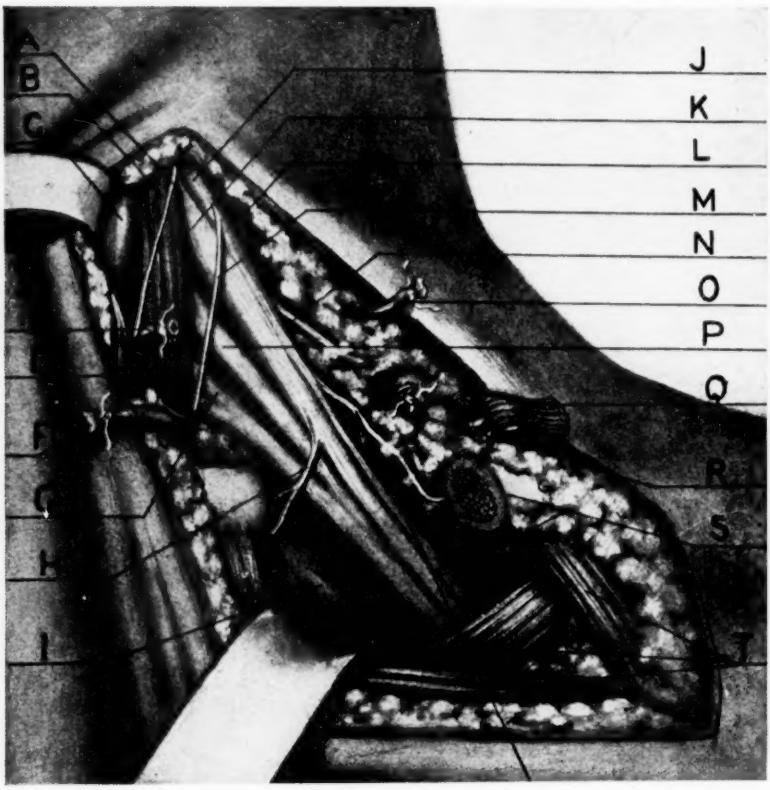
At any time after three months from operation voluntary motion may begin to appear in the paralyzed muscles, and as

FIG. 1.



Operation for relief of brachial paralysis. A, scalenus anticus muscle; B, phrenic nerve; C, internal jugular vein; D, transversalis colli artery; E, seventh root; F, omohyoid muscle; G, fifth root; H, scalenus medius muscle; I, sixth root; J, transversalis colli artery; K, suprascapular nerve; L, external anterior thoracic nerve; M, clavicle; N, nerve to subclavius muscle.

FIG. 2.

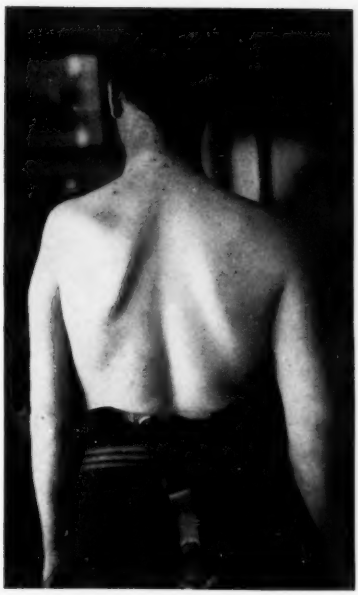


Operation for relief of brachial paralysis. A, phrenic nerve; B, scalenus anticus muscle; C, internal jugular vein; D, transversalis colli artery; E, omohyoid muscle; F, suprascapular artery; G, eighth cervical and first dorsal roots; H, muscular branch; I, subclavian vein; J, fifth root; K, sixth root; L, scalenus medius muscle; M, nerve to subclavian muscle N, suprascapular nerve; O, transversalis colli artery, omohyoid muscle; R, suprascapular artery; S, clavicle and subclavius muscle; T, pectoralis major, pectoralis minor, and deltoid muscles; U, anterior thoracic nerve.

FIG. 3.

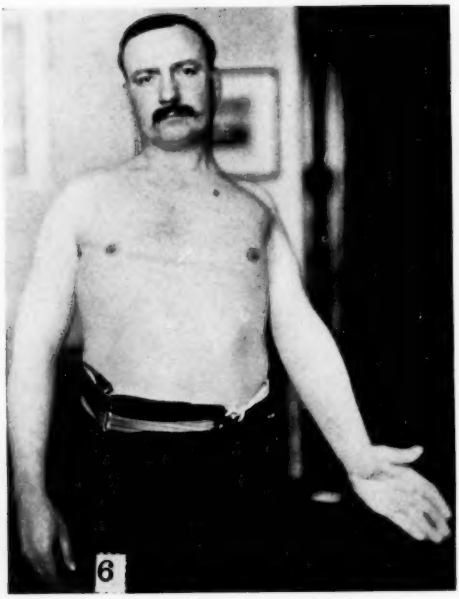
FIG. 4.

FIG. 5.



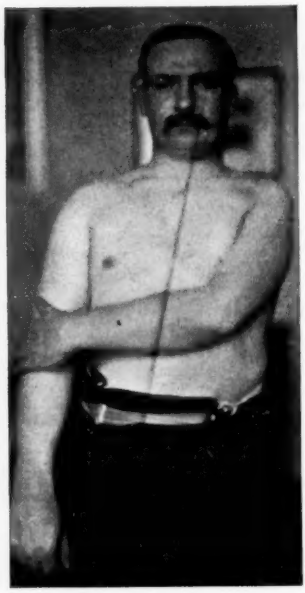
Figs. 3, 4 and 5.—Before operation. Showing flail-joint at shoulder, with marked atrophy of the muscles.

FIG. 6.



Six months after operation. Showing slight abduction at shoulder, and slight supination of forearm.

FIG. 7.



Six months after operation. Flexion at elbow sufficient to grasp opposite arm above the elbow.

they regain their tone the sling may be discarded. With the return of voluntary motion the patient should be encouraged to take systematic exercises for the development of the muscles.

CASE I.— Patrick B., thirty-five years old (with Dr. T. P. Prout). Six and one-half months before operation, while working, his bale hook slipped and he did a half somersault backward, landing on his head and left shoulder. There was immediate complete paralysis of the left upper extremity, except for some motion in the fingers and wrist.

During the period before operation there had been full return of motion and power in the hand and wrist. He had not been able to use the shoulder muscles nor to flex the elbow.

Physical Examination.—There was some voluntary motion in the pectoralis major. The deltoid and spinati muscles were markedly atrophied, and the shoulder was a flail-joint. The biceps and brachialis anticus were moderately atrophied. They could not flex the elbow, which was held firmly extended by an active triceps. There was no supination of the forearm. Mobility and power of the wrist and fingers was apparently normal (Figs. 3, 4, and 5).

The junction of the fifth and sixth roots on the left side of the neck could be felt as a palpably thickened tender mass.

Operation (June 28, 1905).—Ether anæsthesia. The oblique incision from the posterior border of the sternomastoid muscle at the level of the carotid tubercle down to the junction of the middle and outer third of the clavicle was used. The skin, underlying fat pad, and vessels were divided. The deep cervical fascia was found thickened and adherent to the junction of the fifth and sixth roots, which junction was much enlarged and full of hard cicatricial tissue. The deep fascia was dissected off. The lines of section for the removal of the cicatrized nerve passed through the fifth and sixth roots just before their entrance into the junction, through the suprascapular nerve just after its origin from the junction, and through the distal nerve trunks just after their exit from the junction. The segment removed was about 2 cm. long. End-to-end suture was then done with No. 1 silk as previously described.

Good approximation was gotten without much tension.

The wound was closed without drainage, and the dressings were applied so as to hold the shoulder and head in close approximation. (At this time the steel brace had not been worked out.)

Healing was by primary union. The skin sutures were removed on the fifth day. On the tenth day the patient appeared with the bandages in his pocket and his head moving freely, to "give it a rest" as he said. Although the nerve sutures were probably torn out, he refused further operation but consented to being rebandaged and staying for three weeks in the desired position.

He came very irregularly for after-treatment.

September 28, three months after operation, there was slight evidence of voluntary motion in the biceps, brachialis anticus, and supinator muscles of the forearm.

December 24, six months after operation, there was slight power of abduction at the shoulder, well-developed power of supination of the forearm, and sufficient flexion at the elbow so that he could grasp the opposite arm just above the elbow. He could also reach the water faucet with his left hand and turn on the water (Figs. 6 and 7). He then disappeared from observation.

CASE II.—Michael R., thirty years old. Some months before operation he had been thrown off a trolley car, landing on his head and left shoulder. There was complete paralysis of the left upper extremity. The shoulder soon became a flail-joint, to help overcome which the attending doctor had shortened the capsule of the joint.

During the few weeks preceding operation there had been some return of motion in the fingers. All the other muscles were completely paralyzed and considerably atrophied.

There was induration about the fifth, sixth, and seventh roots and the region was markedly tender.

Operation (June 15, 1909).—Ether anæsthesia. The exposure was the same as in Case I. The deep fascia was dissected away and exposed a hard fibrous cord running from the fifth and sixth roots down to a large cicatricial mass under the clavicle. The seventh root also showed fibrous damage. The section ran through the fifth, sixth, and seventh roots near the intervertebral foramina, through the suprascapular just after its

origin, and through the nerve trunks just beyond the cicatricial mass.

End-to-end suture was done by means of chromic catgut. Dressings were applied as in Case I.

(This case was done on short notice in a hospital far out of town, and the complete history both before and after operation which were promised have never made their appearance. The typical history of injury and the characteristic findings at operation make it a case in point.)

CASE III.—Fritz S., thirty-three years old, mechanic, entered the Neurological Institute, Third Division, on February 10, 1911, with paralysis of the left upper extremity.

He had always been well and doing heavy work.

On January 23, 1911, he was caught by the door of an air chamber in a caisson and jammed in such fashion that his left shoulder was crowded downward while his head was pushed well over on his right shoulder, in other words, his head and left shoulder were slowly, forcibly, and very widely separated. He was confined in this position for forty-five minutes, when he was released in an unconscious condition. On the recovery of consciousness he was found to have dislocation of the right shoulder and complete paralysis of the left upper extremity.

Eleven days later there was slight flexion and extension of the fingers of the left hand. Otherwise there was complete paralysis, but with no restriction of passive motion. There were no definite anæsthesias, but all sensations were somewhat dulled over the area supplied by the fourth to the seventh cervical roots (Fig. 8).

There was moderate atrophy of the left deltoid and scapular muscles. The vasomotor condition was normal, the nutrition was good. R. D. was complete in the deltoid, and partial in the biceps.

Dynamometer test showed L. 0, R. 60.

X-ray plates showed no lesion of the cervical spine.

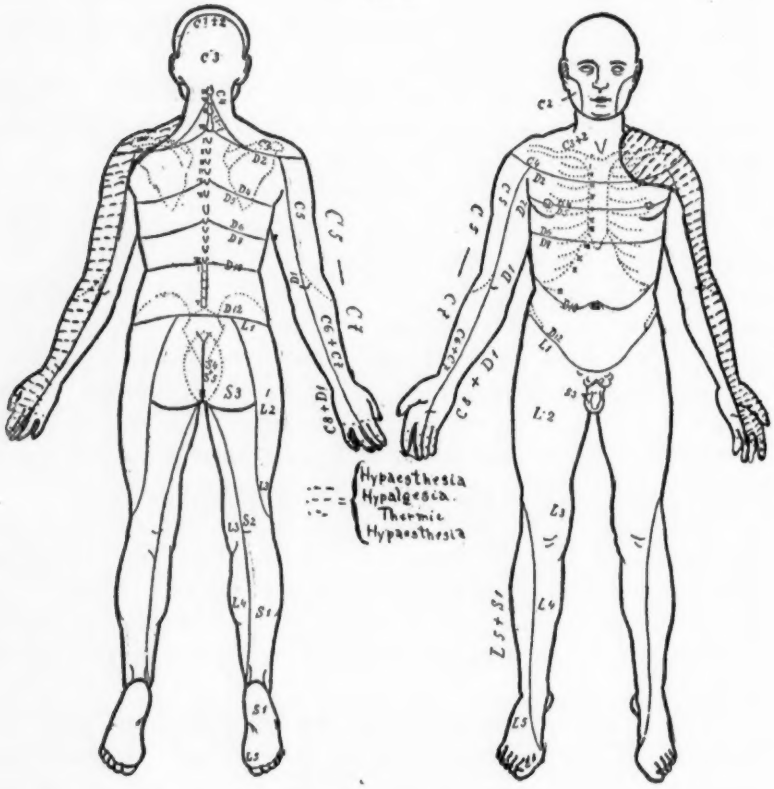
There was no Babinski phenomenon on either side.

February 19, 27 days after injury, there was slight flexion and extension at the elbow and wrist, slight supination and pronation of the forearm, and full range of flexion and extension of the fingers. None of these movements had any power. Dynamometer R. 80, L. 5.

There was very slight sensory improvement. There was no sign of improvement in the shoulder region.

Operation (February 20, 1911).—Ether anæsthesia. The oblique incision previously described was used. The fat and cervical fascia at the base of the neck were very much infiltrated,

FIG. 8.



indurated, and adherent to the front of the plexus roots. This mass of tissue was separated from the plexus and retracted inward. The nerves themselves showed no macroscopic lesions, and were therefore suffering chiefly from the overstretching and from the pressure and adherence of the indurated mass lying in front of them.

During the dissection and manipulation much of the infiltrating material escaped from the fatty fibrous tissues so that

the mass was much smaller and softer when the wound was closed. No drainage was used.

February 23: Voluntary motions were much more rapid than before operation.

February 25: Healing by primary union. Sutures removed.

February 28: A sling was substituted for the steel brace which had developed one or two uncomfortable pressure points. From this time on massage and interrupted galvanism were used. Special massage was given to remove the induration from the tissues in front of the plexus.

The sensory disturbances gradually disappeared. On March 11, 1911, he was referred to the dispensary for continued treatment.

March 23, 1911: All the muscles except the deltoid are stronger. He is able to raise his hand to his face.

Dynamometer L. 80, R. 115.

The sensory disturbances are gone.

The patient disappeared and was not seen again until December, 1912, when the left arm seemed perfectly normal. The deltoid was completely restored and was so strong that he could support the weight of a man on the outstretched left arm.

There were no signs of atrophy or weakness anywhere in the extremity.

CASE IV.—Jas. H., thirty-nine years old, ironworker, came to the Clinic of the Neurological Institute, Third Division, on July 2, 1912, complaining of paralysis and numbness of the right upper extremity. Six weeks before, a hundred pound chain, after falling 75 feet, struck him on the right shoulder. The upper third of the humerus was fractured and a cast was applied. On the removal of the cast four weeks later, there was complete paralysis of the extremity, also numbness of the outer side of the arm. There was no pain.

Examination showed complete flaccid paralysis of the right upper extremity with a flail-joint at the shoulder.

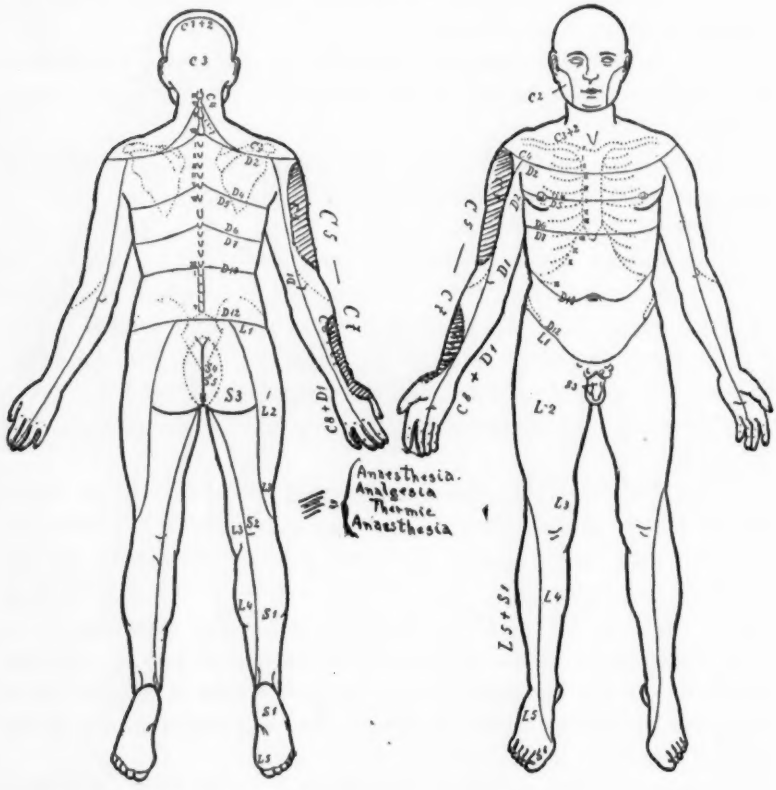
Passive motion was perfectly free. The reflexes were lost. R. D. complete in the right deltoid and biceps. There was some anæsthesia of the arm and forearm (Fig. 9). There were no abnormal signs elsewhere.

Systematic treatment with interrupted galvanism having caused no improvement, he entered the hospital, Third Division,

on August 27, 1912 (14 weeks after his accident). His condition was unchanged except that atrophy of the deltoid and shoulder girdle muscles of the right side had occurred.

Operation (August 29, 1912).—Ether anæsthesia. The oblique incision was made on the right side of the neck. The lesion was found to involve the fifth and sixth roots and their junction. The suprascapular nerve was cicatrized for about a

FIG. 9.



centimetre from its origin. The cicatricial process in the roots extended to just within the intervertebral foramina. The line of section passed through the roots just external to the foramina, through the distal trunks at their origin from the junction of the two roots, and through the suprascapular just beyond the damaged portion.

The two roots were split longitudinally up into the foramina until good nerve bundles were seen. Chromic catgut sutures were passed between the split roots and the distal trunks, including the suprascapular.

When these sutures were tied, the best approximation obtainable still left a gap of 1 cm. between the nerve ends. Cargile membrane was wrapped around the sutures to form a sort of canal. The wound was closed without drainage. The steel brace was applied and was worn steadily for twelve weeks. Good primary union was obtained.

When the brace was removed on November 22, the extremity was very stiff and atrophy, especially around the shoulder, was marked. Sensory symptoms and electrical reactions were the same as before operation.

Active massage and interrupted galvanism were used systematically. In February, 1913, power in the hand was fast returning, there was fairly good flexion at the elbow, but nothing in the deltoid.

April 1, 1913 (seven months after operation), the arm was held close to the body, with the forearm pronated. The elbow could be flexed to a right angle. Supination was not possible.

Abduction at the shoulder to 15 degrees, forward extension to forty-five degrees, and backward extension to normal degree were found.

Dynamometer R. 35 kg., L. 55 kg.

Sensation was improved (see Fig. 10).

CASE V (with Dr. Beling).—Roy S. P., age twenty years, had always been in good health up to the time of his injury.

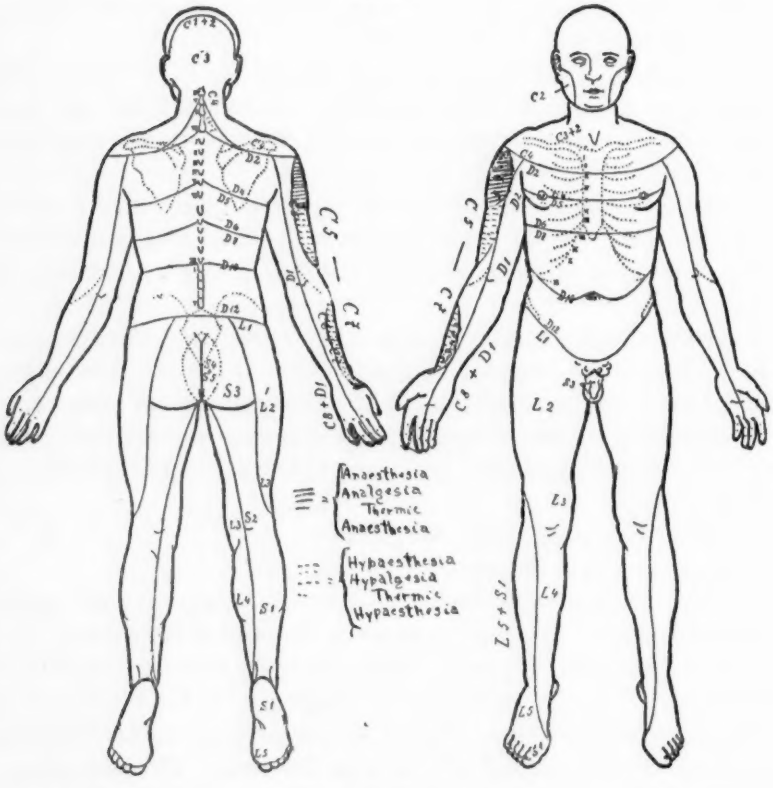
On September 11, 1910, while going 60 miles an hour in a motor-cycle race, he was thrown, landing with his head toward the oncoming machines. As he was scrambling to his feet one of them hit him in the left base of his neck. He was unconscious, the pulse was 150, the left pupil was dilated and did not react to light, while the right pupil was contracted. There was no bleeding from the nose or ears. The sixth and seventh left ribs were broken in the midaxillary line.

For three days there was retention of urine, and for two weeks a low muttering delirium persisted.

Four days after the accident it was noticed that he did not use his left arm.

On September 24 there was a loss of all forms of sensibility over the areas supplied by the seventh and eighth cervical and first dorsal nerves. There was weakness of the triceps, extensors of the wrist and fingers, pronators, pectoralis major, and latissimus dorsi; paralysis of all the flexors of the wrist and fingers, of the thenar and hypothenar eminences, and of the interossei.

FIG. 10.



The sensory symptoms referable to the middle trunk gradually cleared up.

On September 30, a radiograph showed a fracture of the left transverse process of the seventh cervical vertebra with the fragment lying over the region of the eighth cervical and first dorsal roots. At this time he was complaining of severe cramps in the flexors of the forearm.

On October 2, 1910, the left knee-jerk was a little more lively than the right. There was no Babinski and no ankle clonus on either side.

The persistent symptoms were characteristic of the lower arm type of brachial paralysis (Klumpke type). There were associated symptoms of paralysis of the sympathetic, evidenced by homolateral pseudoptosis, myosis, enophthalmus, and an absence of the ciliospinal reflex.

The cramps were very troublesome. They were believed to result largely from irritation caused by the movable fragment of transverse process previously mentioned, inasmuch as they were greatly aggravated by such movements as caused muscular pull on the fragment. It therefore seemed advisable to explore the plexus and to remove the fragment.

Operation (November 1, 1910).—Ether anæsthesia. The oblique incision was used for the exposure of the plexus. The loose fragment of bone was found to consist of the anterior half of the left transverse process of the seventh cervical vertebra, and was displaced downward, pressing somewhat upon the eighth nerve-root. This fragment was removed. Examination of the roots of the plexus showed no macroscopic evidence of damage, so the wound was closed and the extremity placed in a brace to prevent the drag of the paralyzed extremity on the nerve-roots.

After three weeks the brace was replaced by a sling and the extremity was given massage and electricity at the irregular times that he appeared for treatment.

There was a gradual return of power in the muscle groups supplied by the fifth, sixth, and seventh roots. The cramps were diminished in frequency and severity but did not entirely disappear.

After 28 months there had been no improvement in the muscles supplied by the eighth cervical and first dorsal; on the contrary they had undergone marked atrophy. Remembering that these roots, at the time of the operation, had shown no macroscopic evidences of injury, it seemed, from the persistent paralysis, that they must have been torn from the cord at the time of the original accident, and that the only thing left to do was to transplant them to some of the other roots.

On January 19, 1913, Dr. Beling made the following notes:

Circumference.	Right.	Left.
Mid-arm	9¾ inches	8¼ inches
Below elbow	9⅝ inches	8½ inches
Wrist	6¼ inches	5⅞ inches

The triceps was weak with partial R. D. Biceps in good condition. Deltoid in fairly good condition. The lower portion of the pectoralis major was atrophied, the upper portion in good condition. Pectoralis minor rather weak.

The muscles supplied by the eighth cervical and first dorsal were markedly atrophied, completely paralyzed, and showed complete R. D. Left wrist-jerk was absent.

There was no Babinski phenomenon and no ankle clonus on either side.

The knee-jerks were about equal and normal.

Operation (January 20, 1913).—Ether anæsthesia. The two lowest roots of the left plexus were exposed by the transverse incision. They showed no cicatrices within their sheaths and were not adherent to the surrounding structures. They were easily isolated. They seemed somewhat softer than normal roots. On cross section at their exit from the foramina they showed considerable yellowish, fatty substance within their sheaths and the nerve bundles were not nearly so definitely arranged and visible as in normal roots.

The two roots together were implanted into a longitudinal slit in the side of the junction of the fifth and sixth roots, with fine chromic gut sutures. The seventh root was none too good at innervating its own group of muscles, so was not considered for the grafting process.

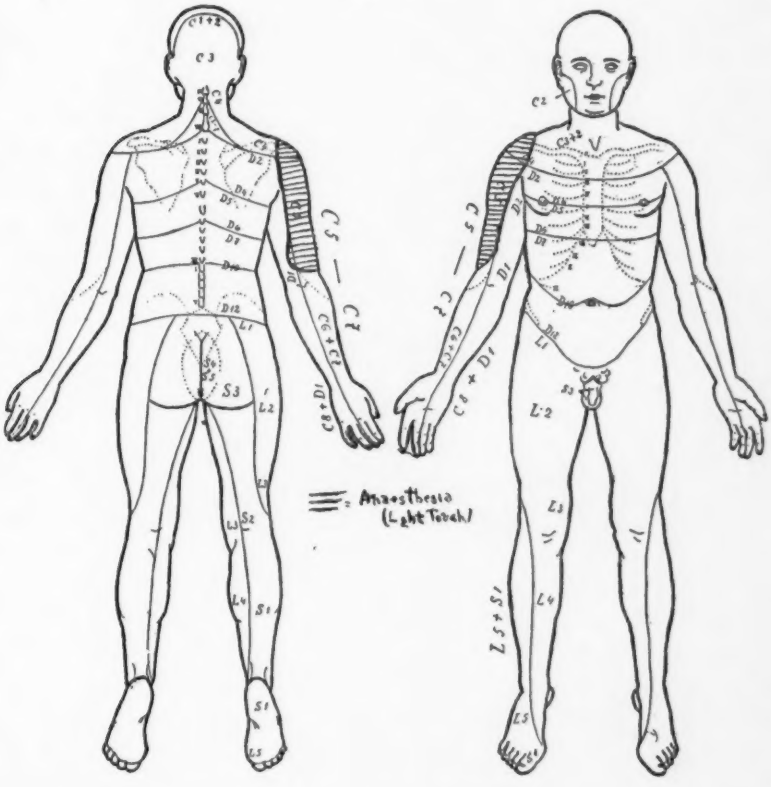
The wound was closed without drainage and the extremity put up in a sling, which was worn for three weeks.

Sufficient time has not elapsed for results to have appeared.

Case VI.—Jeanne G., forty years old, was admitted to the Third Division of the Neurological Institute on January 21, 1913, with paralysis of the right upper extremity. About five weeks before, she had fallen backward out of a window about five feet to the ground, striking first on the left hand and sustaining a Colles fracture, then rotating so that her right shoulder and head struck. The right upper extremity was paralyzed.

Physical Examination.—It was seen on admission that motions of the wrist and hand were fairly well preserved, but that elsewhere in the extremity there was complete flaccid paralysis. Passive motion was unobstructed. The reflexes were abolished in the right upper extremity, but were normal everywhere else in the body.

FIG. 11.



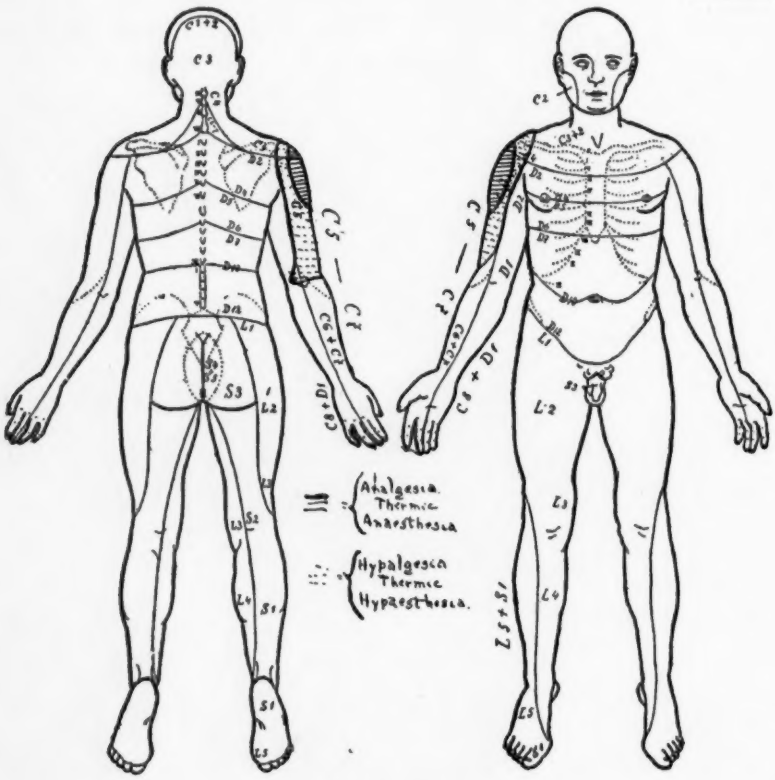
There were no apparent muscle atrophies, but the muscle tone in the deltoid, biceps, and triceps muscles was much diminished.

R. D. was present in the deltoid and much diminished excitability in the biceps and pectoralis major.

There was anæsthesia to light touch over the area of the right fifth cervical root. To pain and thermal stimuli the area of anæsthesia was smaller but was surrounded by an area of hypalgesia coincident with the distribution of the fifth root (Figs. 11 and 12).

Operation (January 21, 1913).—Ether anæsthesia. The transverse incision previously described was used in this case. The fat pad was divided in the same line, exposing the damaged deep cervical fascia adherent to the plexus. When this was dissected away it was found that the fifth root had been completely ruptured just above its junction with the sixth, the sixth root had

FIG. 12.



been almost torn across but was still connected by a cicatricial band about 2 cm. long with the junction of the fifth and sixth roots, which had been displaced toward the clavicle about that distance. The seventh and eighth roots appeared undamaged.

The line of section went through the fifth and sixth roots about 0.5 cm. external to the foramina, through the junction of the two near its distal end, and through the suprascapular near

its origin. Silk sutures were used and complete approximation of the nerve ends obtained. The wound was closed without drainage and the brace applied.

Primary union was obtained. The brace is still on.

COMMENT.

The series of cases reported in this paper has given results that are so far by no means brilliant. The last half of the series is still in process and no one can tell what the final results will be.

In five out of the six, lesions were found that precluded anything like satisfactory spontaneous recovery.

In the first case, in spite of his removing the restraining dressings and probably rupturing the nerve sutures, the patient regained some power in muscles innervated by the roots from which the cicatrix had been excised, showing that some regeneration had occurred even under most adverse circumstances.

In Case II no post-operative information has ever been obtainable, but a lesion was exposed and removed which would have caused permanent paralysis in the muscles supplied by the fifth, sixth, and part of the seventh roots.

In the third case, while there was no macroscopic lesion of the roots, there was distinct interference with nerve function caused by the densely infiltrated tissues of the base of the neck, which were firmly adherent to the front of the roots. The operation not only loosened up this adherent material, but gave precise information upon which to base the treatment which led to steady improvement and final complete recovery.

In the fourth case there seemed, at the time of operation, very little hope for a good result. The cicatricial tissue extended up into the foramina in both the fifth and sixth roots so that they had to be split longitudinally to expose good fibres; the cicatrix was extensive and required free excision; the suture could not bring the distal trunks nearer than 1 cm. to the damaged root stumps. In spite of these handicaps, at the end of seven months from operation, the patient is showing

decided signs of nerve regeneration and returning muscular power.

In the fifth case, where the two lowest roots were probably torn from the cord, the transplantation has been done too recently to afford any evidence of nerve regeneration.

The sixth of the series ought to give a very good result. The patient was operated upon five weeks after the accident, the nerves above and below the cicatrix were good, and the approximation by suture was nearly perfect. We shall hope to show this case when sufficient time has elapsed for recovery to have occurred.

These plexus injuries are by no means rare, and yet there is no well-settled system of management of them which is generally recognized by the surgical side of the profession. This fact is illustrated by the following two instances which have come within our knowledge: A young man fell from a freight car, landed on his head and left shoulder, and suffered complete paralysis of the left upper extremity. Six weeks later he was sent into one of the large general hospitals of this city. Exploration showed complete rupture of the plexus with wide-spread formation of scar tissue. The wound was closed with no attempt at repair, the man was told never to let any one attempt to do anything with the plexus, by another operation, and he was turned loose with the flail extremity unsupported and dragging on the plexus and muscles so that any chance of partial spontaneous regeneration was lost. In this case resection of the cicatrized plexus together with resection of the middle part of the clavicle would have allowed sufficient approximation of the nerve ends to have given some chance of regeneration and later usefulness.

In the other case a man had his left plexus completely ruptured by the kick back of the starting lever of a big marine engine. He was taken to a well-known hospital, not in New York City. The day after injury the plexus was explored but no attempt at repair was made. On the fourth day, for some unexplained reason, the extremity was amputated at the shoulder.

These two cases indicate the necessity of bringing the subject forward for discussion.

SUMMARY.

Traumatic Erb's paralysis in the adult is by no means rare.

The cause is practically always a forcible wide separation of the head and neck from the corresponding shoulder.

The resulting lesion consists of torn deep cervical fascia, torn nerve sheaths, torn nerve fibres, torn vessels with resulting blood-clot. All of these elements combined form a cicatrix or cicatrices which interfere with nerve regeneration and function.

In nearly all cases the injury involves the roots in order from above downward, and the maximum injury is to the upper roots.

The roots may be torn from the cord, although fortunately this is not so very common. The cicatrices in the other cases may be small, large, single, or multiple, and may be located anywhere from within the intervertebral foramina out to the distributing trunks which arise from the plexus.

The symptoms depend upon the situation of the cicatrices and the number of roots involved. The paralyzed muscles fall into groups which correspond with the plexus roots from which they derive their innervation. The sensory symptoms are neither so definite nor so wide-spread as the motor, and they are apt to disappear much sooner. The completely paralyzed muscles show R. D., while the less completely paralyzed ones show various degrees of sluggishness to the testing currents. The lesion can always be felt through the skin by the examining finger.

The prognosis, where there is a real lesion, is distinctly bad without operative repair. With prompt operative repair the outlook is much improved, but a really perfect result is not to be attained in many cases.

The only rational treatment consists in prompt exploration with such repair of nerve structures as may be indicated in

the individual case. If no macroscopic injury is found, practically nothing but a skin wound has been made. After the few days required for healing, the after treatment may be started vigorously and with exact knowledge of the condition to be dealt with. If gross injury is found it can be repaired at once and so cause the least loss of time to the patient, and give the most favorable opportunity to the nerves for complete repair.

Operation consists in the resection of the damaged areas of nerve, followed by end-to-end suture of the roots and trunks.

In bad cases where the resection has been so extensive that approximation by suture is impossible, resection of the middle of the clavicle will greatly facilitate the approximation. An extremity that will move, even with the clavicle absent or distorted, is very much to be preferred to one that is paralyzed but with the clavicle intact.

After-treatment consists in the wearing of some fixation apparatus for from six to twelve weeks, which shall keep the neck and shoulder of the damaged side in close approximation to favor firm anatomical and physiological union of the nerves. With the removal of the fixation apparatus the various forms of physical therapeutics should be systematically employed.

Results are late in appearing and will seldom be perfect.

SPLENIC ANÆMIA, WITH SPECIAL REFERENCE TO ETIOLOGY AND SURGICAL TREATMENT.*

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SPLENIC anæmia, although recognized as a pathologic entity even in the early years of the nineteenth century, presents to-day many unsolved problems. This condition has been described under various names during the past twenty-five years but at the present time splenic anæmia is the generally accepted term. By it we mean a disease of long duration, generally lasting several years, characterized by an anæmia of the chlorotic type, considerable enlargement of the spleen without known cause, an absence of leucocystosis and a tendency to gastro-intestinal hemorrhage. In the advanced stage, cirrhosis of the liver, ascites and jaundice are also present. Banti, Osler and others have fully described the course of the disease and divide it into three distinct stages.

The first stage lasts two to ten years, with splenomegaly, anæmia, gastro-intestinal hemorrhage and pigmentation of the skin as its prominent symptoms. The second stage lasting only a few months adds to these symptoms kidney insufficiency with scanty high-colored urine. The third and terminal period presents the stage of liver involvement in which appears a cirrhosis of the Lænnec type with its accompanying ascites.

* Read before the Philadelphia Academy of Surgery, May, 5, 1913.

The name, Banti's disease, has been applied incorrectly to all three stages but it is the symptom-complex of the ascitic stage alone that should bear the name of the man who did so much to clear up its symptomatology and pathology.

During the first stage, there are usually marked fluctuations in the severity of the symptoms. Months may pass in which slight enlargement of the spleen is the only demonstrable lesion. Again during the exacerbations, the spleen may enlarge enormously, with coincident increase in the anæmia and icterus.

Etiology.—The etiology of splenic anæmia has proved baffling. Much confusion has arisen and the main purpose befogged in endless discussion as to whether or not the splenomegaly is primary or secondary. The mere fact that we have first this splenomegaly is important, but not necessarily convincing that it alone is responsible for the anæmia, the cirrhosis and endophlebitis of the splenic and portal veins. Rather would it seem more reasonable to us that the splenomegaly was a link in the chain which resulted from the chronic irritation of some as yet unknown toxin, probably of gastro-intestinal origin. Having once acquired splenomegaly, we believe that it is responsible for the anæmia by reason of an exaggeration of its normal hæmolytic functions. In other words, the spleen finds itself much in the same position as the thyroid, which, as the result of some irritation, increases its activity and thus brings about hyperthyroidism. It is logical to assume this because we know that splenectomy, if done in the first stage, stops the anæmia with an early return of the blood picture to normal. Here again, comparison with the results of partial thyroidectomy are apt, since there too an excessive physiological function is checked. But we do not have to depend on splenectomy alone to feel sure this is so. Banti in his latest paper states that the anæmia is due to increased hæmolysis chiefly, and secondly to an actual increase in the blood destroying units of the spleen.

Banti, Joannovico, Lemarre and Gaucher have shown that splenectomized dogs have an increased resistance to certain

hæmolytic poisons (pyridine, etc.). F. Bartazzi has also shown increase in the red blood corpuscle resistance in splenectomized dogs. Pagliesi and Tuzzati, later Charrin and Moussie, and later still Gaucher, have shown that splenectomized dogs have a considerable lessening of biliary secretion. The logical conclusion is that the spleen has a great influence on hæmolytic and bilogenic processes not only because it diminishes red cell resistance and prepares them for destruction in other organs, but because it destroys them directly and forms thereby the necessary substances for biliary secretion.

The part that the enlarged spleen plays in the production of the anæmia has given rise to other theories. Harris and Hertzog believe that by reason of an erythrolytic enzyme secreted by the endothelial cells of the hyperplastic spleen there is a destruction of red blood corpuscles, and cite splenectomy with its cure to substantiate them in their position. Barr thinks that an increased blood supply to the spleen, with its consequent fibrosis, causes increased hæmolysis. The congestion is explained on a theory of vasomotor paresis of the splanchnic area from disease of the visceral sympathetic ganglia. Lintvarev believes that the anæmia is due to an increased destruction of the red cells by the erythrophages of the spleen, which cells have been produced in excessive numbers because of certain poisons (exogenous as well as endogenous). Rolleston would explain the anæmia upon an inhibition of blood formation due to the endothelial hyperplasia found in the enlarged spleen. So, while opinions differ as to the actual manner of accomplishment, it seems reasonably certain that the spleen causes the anæmia. Banti's theory of increased hæmolysis brought about by lessened resistance of the red blood corpuscles so that they are destroyed in greater proportion in the liver, lymph nodes and spleen itself, seems to us the most satisfying, since it is based on reliable experimental evidence and clinical findings. In these cases we have icterus without decoloration of the fæces, and we find that in periods of aggravation of the disease a further diminution of

the red blood corpuscles and hæmoglobin is coincident with augmentation of icterus and urobilinuria.

The question of the primary intoxication is by no means so definitely settled. Senator was perhaps the first to suggest that the toxin was absorbed from the gastro-intestinal tract. Others have followed accepting this theory, some offering clinical data to substantiate their position. Ostrowski, who states that in ten cases of splenic anæmia in children all had had an antecedent diarrhœa, and Ungar and Neuberg believe that the gastro-intestinal tract must be looked into. It would seem not illogical to assume that the gastro-intestinal tract might furnish the toxin because of the somewhat similar clinical picture that is found in protracted auto-intoxication and in the beginning of splenic anæmia. Banti, however, adhering to the infectious theory, does not believe that the irritant comes from the gastro-intestinal tract, reasoning that the atrophy occurring in the liver from cirrhosis due to auto-intoxication is not produced for years, whereas that occurring in the liver during the third stage of splenic anæmia occurs in a few months. Conflicting ideas also are advanced as to casual relation existing between splenic anæmia and certain diseases, as tuberculosis, syphilis, Kala-Azar, malaria and gout. Banti again thinks that his syndrome, when occurring as the third stage of splenic anæmia at least, is a disease *sui generis,* but does not deny that enlarged spleen, cirrhosis and ascites may be found in the terminal stages of other diseases, as is pointed out by Hultgen, Rolleston and others. Osler thinks that when secondary anæmia and splenomegaly are found in other conditions the differential diagnosis may be made, since (*a*) the cause is usually apparent as malaria, tuberculosis, syphilis, etc., (*b*) the anæmia and splenomegaly usually yield to appropriate treatment, (*c*) the spleen is not so large, (*d*) sequences not so characteristic, (*e*) the blood, while showing secondary anæmia, does not usually show the exaggerated chlorotic type, and (*f*) leucocytosis is more common than leucopænia.

We know that the spleen is not rigidly controlled by

nervous influences from the central or sympathetic nervous system, but that its stimulation depends largely upon the circulation of systemic blood which comes in direct contact with the parenchyma of this organ. Further, that a part of its physiologic function is to sift out from the circulating blood bacteria, toxins and other detritus. These facts offer additional theoretical evidence of the probable toxic nature of the primary irritant.

Certainly one of the most interesting problems to be solved is the connection between endophlebitis of the portal and splenic veins and the enlarged spleen. Is the thrombosis primary or secondary? That some relation exists is reasonably certain, because of the frequency with which thrombosis of the portal and splenic is found at autopsy in cases dying of splenic anæmia. The reports of Dock and Warthin, Oettinger and Fiessinger, Banti, Rolleston and many others amply attest this fact.

It was really to attempt to shed additional light on this phase of the question that led the authors to carry out experiments on animals.[1] Our aim was first to produce thrombosis of the portal and splenic and later to study the splenic changes and blood picture. It seemed easy to ligate the splenic vein and cause a passive congestion of the spleen which would, in a measure, at least reproduce what actually occurred in cases of portal and splenic thrombosis. This we did in seven dogs, and found that in every case the immediate enlargement of the spleen was enormous, but in none of our cases did this increase in splenic dimensions last longer than one month, to be followed by permanent atrophy of the organ. The results coincide with Warthin's earlier ligations of the splenic vein. In another series of three dogs and two rabbits ligation of the splenic veins and injection of aleuronat directly into the splenic pulp were tried. Here again, in every instance, temporary increase in the size of the spleen followed with local necrosis of the splenic pulp at the injection sites. The splenic congestion with its consequent enlargement gave way to permanent atrophy. The aleuronat was used to supply an irritant and was chosen because we wished to produce an inflammation that would stop short of pus formation. Feeling that ligation, with its sudden congestion, did not reproduce the actual pathological condition, we attempted partially to occlude the lumen of the splenic vein. This we did by metal clips and loosely tied ligatures in a series of three dogs. Slight enlargement of the spleen occurred temporarily, to be followed in three weeks by a return to the normal size. Having failed with the splenic we next tried, in a series of five dogs, to produce portal thrombosis by exposing the vein,

[1] All experimental work on animals done under ether anæsthesia.

breaking the intima by compression and partially occluding the lumen by means of a silver wire passed around the vein, so as to constrict, but not totally obstruct it. In no case were we able to produce by this means portal thrombosis, although slight temporary enlargements of the spleen were again noticed to measurements.

The pathological studies of the removed spleen following ligation showed passive congestion in the early cases, that is, those removed not later than one month after operation, but no real hyperplasia of the splenic substance. In the later cases, those removed after one month or longer had elapsed, there was atrophy of the splenic pulp and an increase in connective tissue. The blood pictures during the period of splenic enlargement showed no characteristic change beyond a leucocytosis following operation, which returned to the normal after an average period of two weeks had elapsed.

Other experimental work has been done; thus Solowieff produced a fibroid condition of the liver by producing occlusion of the portal branches in dogs. Osler cites a case of his own, however, in which there was obliteration of the portal but no true cirrhosis, although the liver was atrophied and had undergone fatty degeneration to some extent. This case showed enormous enlargement of the spleen with the thrombosis of some of the splenic veins and with that of Cruveilhier, shows that obliteration of the portal can take place in man without cirrhosis of the liver. Banti reports the results of an extensive bacteriological study. Believing that the disease is bacterial in origin, he cultured the peripheral blood, splenic substance, blood of splenic vein and bone marrow in fatal cases without result. Aërobic and anaërobic cultures were both negative. In addition, guinea pigs, rabbits, dogs and rats were injected with the blood, splenic juice, liver and bone marrow without result. Fragments of spleen, liver and bone marrow have been directly injected under skin and into the peritoneal cavity still without infection. Finally Banti grafted pieces of the diseased spleen into the normal spleen of dogs, also without result. He states that similar bacteriological studies by others have always yielded negative findings. Although these experiments have been thoroughly carried out the parasitic origin of the disease has by no means been disproved. The cellular hyperplasia of the spleen in this condition is suggestive of an irritation due to bacterial or at least protozoal growth. Again, in the diseases most closely simulating splenic anæmia, such as tuberculosis and syphilis of the spleen, malaria, etc, specific organisms have been isolated.

Pathology.—Many observers have carefully studied the pathology of splenic anæmia. In the main they agree as to the macroscopic and microscopic picture of the disease. In brief, the essential pathology is first an anæmia of the chlorotic type, the microscope showing marked aniso- and pœcilocytosis, polychromatophilia and often basophilic de-

generation of the red cells, with the occasional finding of normoblasts and myelocytes. Secondly, an enlargement of the spleen which weighs on an average 61 ounces. It retains its normal shape, is dense and firm and under the microscope shows a general fibrosis, especially of the malpighian bodies, which are sclerosed and atrophied and often show hyaline degeneration. In addition, the blood spaces show marked hyperplasia of the endothelial cells and many large phagocytic cells, spoken of by Lintvarev as macrophages. In the third stage the liver shows a varying degree of atrophic interlobular cirrhosis, closely corresponding to that seen in chronic alcoholism. In addition, in a large majority of cases, there is reported an obliterating thrombophlebitis in various stages of degeneration of the splenic and portal veins, which often show almost complete obliteration of the lumen.

Treatment.—In the treatment of splenic anæmia, as in its etiology, a great diversity of opinions is met with. Medicine and surgery have had their advocates and opponents. With the rapid advance of surgical technic in the past few decades, the operative treatment now offers the greatest chance for permanent recovery.

In the medical treatment, iron and arsenic stand preeminent. They are of undoubted value in combating the anæmia and in improving the general condition, but at the best they are only temporary aids and in no way counteract the causal factor. Up to the present time literature shows no cases of permanent cure by medical treatment alone.

As our knowledge of the etiology of this condition advances, the medical treatment will of a certainty become more valuable, especially in the early stages. If we can but discover the primary intoxicant and attack this before the spleen is permanently damaged, our therapeutic agents will become powerful factors in what may be called the prophylactic treatment of splenic anæmia. At the present time, the early eradication of any chronic source of intoxication, especially of the alimentary tract, must be of general if not of specific benefit to the patient. As an example, a case of one of the authors may be cited.

A man, forty-six years of age, suffering from mild anæmia of two years' duration, with its usual symptoms and with a spleen reaching to the level of the umbilicus, was examined early in the year. His past history was negative with the exception of occasional attacks of gastro-enteritis and chronic nasal catarrh. An examination showed chronic frontal sinus trouble and marked gingivitis with symptoms of gastric and intestinal stasis. After several months of treatment for these conditions there has been a decided improvement as to the blood and spleen, and marked betterment of the patient's subjective symptoms. The case has been under observation for too short a time to definitely decide whether the improvement is to be more than temporary.

The intravenous injection of salvarsan has been used for this condition and its results parallel those of internal medication, *i.e.,* improvement in symptoms without permanent recovery.

Treatment by X-ray has been tried at various times. Lucatello reports a marked improvement in general condition in the blood and in the spleen for a time, but the relief from this, as from medicine, is only temporary.

In taking up the surgical treatment it may be wise to review the topography of the spleen. We are dealing with an organ of the upper abdomen, lying well within the vault of the diaphragm and overlaid anteriorly by the fundus of the stomach and posteriorly by the ribs. It is securely held in place by its ligaments and in the disease under discussion is often additionally fastened to the surrounding organs and parietes by firm adhesions. Its blood-vessels are large and extremely thin-walled, making ligation a serious matter. The splenic pulp is brittle and tears and bleeds easily under rough handling.

With these points in mind, the difficulties of operative procedures can readily be estimated. Proper exposure is the first essential. Mayo, Meyer, Treves and others have suggested various methods of approach, all of which have many points of merit. We would like to call special attention to a modification of the incision described by Dr. Edward Martin for exposure of the liver and which, in the dissecting room

FIG. 1.

FIG. 2.

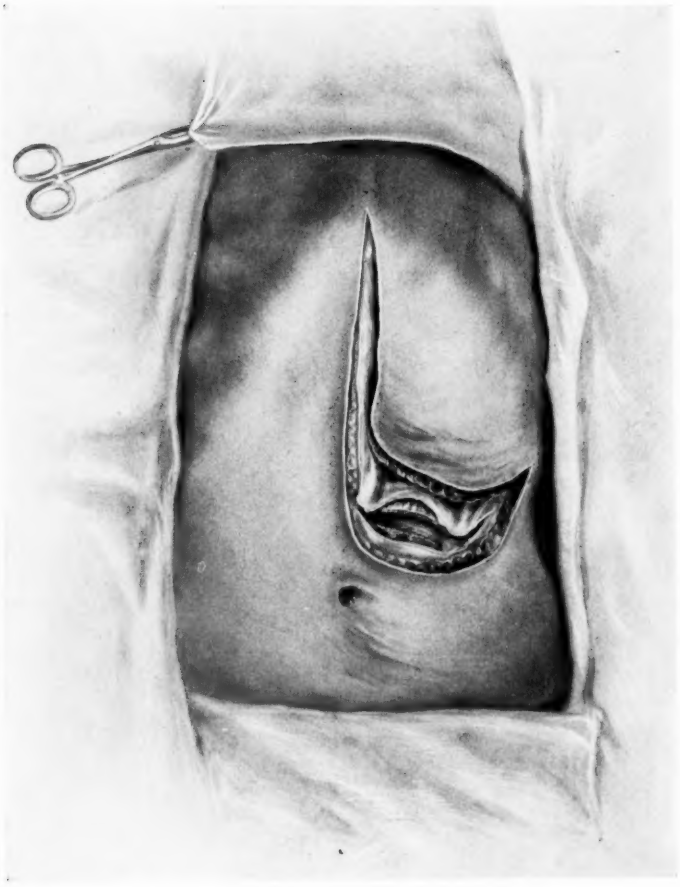

FIG. 3.

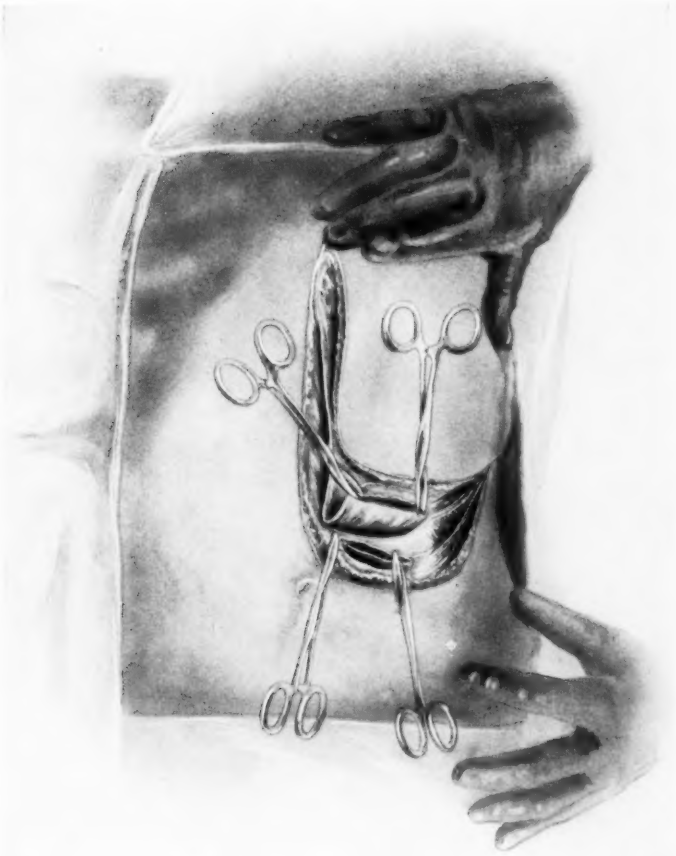

Fig. 4.

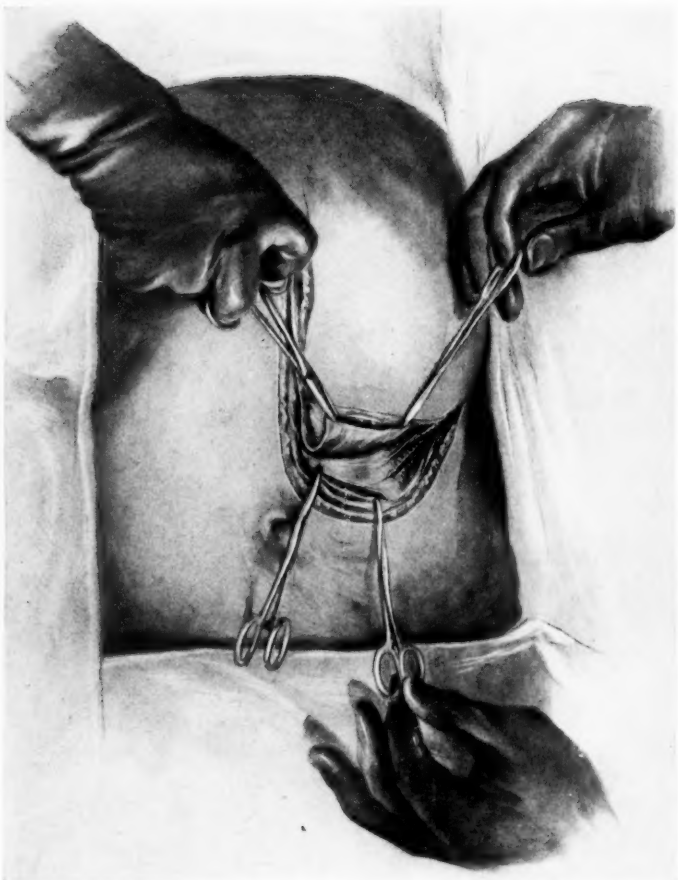

FIG. 5.

at least, has given us the best access to the upper left quadrant of the abdomen.

The incision used is a reversed " J " (see Figs. 1–5). The vertical portion starts one cm. to the left of the middle line, at the tip of the ensiform cartilage and is continued downward to the level of the umbilicus. It is then carried outward across the rectus and outward and upward toward the tip of the seventh rib. The rectus muscle is cut transversely, preferably at the linea transversa. The external oblique and the transversalis muscles are separated in the direction of their fibres; the internal oblique fibres are cut across. The flap can then be turned up and out giving free access to the splenic area.

We consider that this incision not only gives us the best operative exposure but also greatly lessens the dangers of post-operative hernia. The blood supply of the flap is not interfered with on account of the free anastomosis with the vessels of the chest. The nerves supplying this area, coming as they do from the lower intercostals, run parallel with the transverse portion of the incision and therefore are not cut across. The transverse incision of the rectus has already proven satisfactory and the splitting of two of the three layers of the lateral wall adds greatly to the post-operative strength.

Having obtained the proper exposure, the greatest remaining difficulty lies in the efficient ligation of the vascular pedicle. Mayo and Sutherland both strongly urge the use of a temporary rubber covered clamp on this pedicle before ligation and the thorough testing of the ligatures before the complete removal of the clamp.

Extirpation of the spleen has been performed for various conditions by many operators and the consensus of opinion is that while the operation is a serious one with high mortality, it is entirely justifiable under certain conditions. The statistics for splenectomy from any cause compiled by Bessel Hagen in 1900, and by Johnson in 1908, show a mortality of 36.3 per cent. in a series of 353 cases and of 18.5 per cent. in a series of 355.

In splenic anæmia, splenectomy during the first and second stages gives far better results than any other form of treatment. The production of toxins which affect the blood, liver and other organs is stopped and nature is given a chance to repair the damage already done to the rest of the system. The anæmia rapidly decreases. The resistance of the red blood cells is increased to above normal. The icterus and gastro-intestinal symptoms disappear and weight and strength are regained. The effects of the removal of the spleen in this condition resemble closely those following thyroidectomy for exophthalmic goitre. In both, the secondary and presumably the major, but not the primary source of intoxication, is removed, and the resultant marked improvement in the patient's health, while perhaps not so rapid, is as sure and as permanent from splenectomy as from thyroidectomy.

In cases reported up to the year 1908 splenectomy in the first or second stage gives a mortality of 17 per cent. This figure is based on the reports of Simmonds and Torrance, who collected in all thirty-five cases, with only six deaths. From 1908 to 1912 the results have been even more favorable. Forty-seven cases have been reported by various authors in which splenectomy has been performed before the appearance of Banti's symptom-complex. Of these cases only 5 or 10 ⅛ per cent. have died. It is impossible to state with absolute confidence that splenectomy gives a permanent cure, but at least it can be said that the majority of these cases have been followed for 1 to 9 years after operation and a few have been under observation for 12 years and in no case has there been a return of the previous symptoms.

A case reported by Banti may be cited as typical of the great improvement brought about by early splenectomy. The patient, fifty years of age, with a history of typical symptoms lasting over a period of fourteen years, was operated upon in February, 1903. In October, 1902, the blood count showed Hb. 60 per cent.; R.B.C. 3,760,000; W.B.C. 8,180. In February, 1903, just before operation, the count was Hb. 25 per cent.; R.B.C. 1,615,000; W.B.C. 7,060. One week after operation Hb. was 35 per cent.; R.B.C. 2,565,000; W.B.C. 26,000. Ten months later Hb. and R.B.C. had reached normal and W.B.C. were down to 11,000. The counts taken two, five and nine years later were normal in every respect. In 1911, when the last count was taken there had been no return of symptoms.

In the third stage however, we find a very different story. Here the results of a chronic poisoning have asserted themselves. The vital organs are showing signs of permanent degeneration. The liver has become cirrhotic and we are dealing not with an anæmia alone, but with a degenerative process affecting many organs. Nothing we can do to the spleen will restore the liver cells already destroyed, or prevent the symptoms arising from such destruction. All that we can hope for is to prevent further degeneration. For this reason splenectomy in the third stage has given much poorer results than in the early stages, although a few isolated cases have been reported showing complete recovery in early third stage following splenectomy. In 1908 Simmonds reported six cases following splenectomy, with four deaths, and Torrance five cases with four deaths, giving an average mortality of 72.7 per cent. In the past four years sixteen cases are reported with 9 deaths, giving a mortality of 56 ¼ per cent.

It is perhaps unfair to place too great reliance on the statistics just given. In a disease as rare as the one under discussion, it is extremely unusual to find more than one or two cases reported by a single author. Only the very largest clinics can report a sufficient number of cases to make the statistics reliable. The majority of the single cases reported show a favorable result and it is only reasonable to suppose that many terminating unfavorably have not found their way into literature. However, in the past two years, two articles reporting a series of cases have been published and on this account should perhaps deserve special mention. Mayo, in 1910, reports ten cases of splenectomy for enlarged spleen. Seven of these were undoubtedly splenic anæmia, five being in the early stage, and two in the terminal stage; of these, one resulted fatally and was a case showing advanced cirrhosis of the liver and ascites. The other article by Urbino comes from Burci's Clinic, in Florence, and reports seven cases in the early stages with one death, and two cases in the terminal stage, both of which died.

In the past few years the combination of splenectomy and Talma's operation has been suggested and successfully accom-

plished. It undoubtedly holds out more chances for permanent relief and would seem to be the most rational procedure in the ascitic stage. The attempts are yet too few to state the results with any accuracy.

Complications.—The convalescence following splenectomy varies in no way from that following any operation on the upper abdomen except in two points: First, the danger of gastro-intestinal hemorrhage and second, the lowered resistance to any secondary infection. Hemorrhage into the stomach or upper intestines is the most common as well as the most severe complication. It may occur immediately after operation or at any time during the first two weeks. The loss of blood may be rapid, or as is usually the case, the leakage may be slow, persistent oozing from the mucous membrane of the stomach and upper intestines. It is the most common cause of death in the first two weeks. The frequency of its occurrence cannot be readily estimated. Urbino lays emphasis upon it and noticed it in five out of seven cases. Mayo mentions it as a cause of death in the only fatal case in his series. The treatment consists in absolute rest of the upper gastro-intestinal tract; injections of saline, vasoconstricting drugs, blood serum, or even direct blood transfusion. A case of Dr. Donald Guthrie's, operated upon during the past year, may be cited as typical of this condition.

This case, a young adult male, was seen by Dr. Guthrie in November, 1911. The examination at this time showed a case of splenic anæmia of three years' duration, in the second stage. The blood picture gave a hæmoglobin of 46 per cent.; R.B.C. 4,230,000; W.B.C. 5,600. The lower border of the spleen extended into the pelvis. Splenectomy was performed. During the first five days after operation the recovery was uneventful. At this time he began to pass small quantities of blood by the bowel. This lasted two days and was controlled by injections of normal blood serum. Patient then had no trouble for one week and was able to be up and about in a wheeled chair. At that time he again had attacks of bloody diarrhœa and in spite of saline and blood serum injections the hemorrhage recurred and he died three days later. A post-mortem was made. The vascular pedicle of the spleen was found to be in good condition. In the lower half of the small intestine the mucous membrane showed innumerable small hemorrhagic areas. The mucous membrane of the stomach and of the upper small intestine showed congestion but no hemorrhage.

The danger of secondary infection can perhaps be classed as a post-operative complication. There is undoubtedly a lower resistance to any of the pathogenic organisms, which lasts for months after the removal of the spleen. This fact has been amply proven both by the clinical findings and by experimental work on splenectomized animals.

A case operated on by Dr. C. H. Frazier, in the Hospital of the University of Pennsylvania, during the past winter, is a good example of this condition. A colored girl, aged eighteen years, with a splenic anæmia in the first stage was operated on and the spleen removed. Her convalescence was uneventful until the tenth day when she began to run a temperature and developed signs of pneumonia and pleural effusion at the left base. This was followed three days later by an empyema which was tapped and a few ounces of sterile turbid fluid removed. The chest condition gradually improved. Thirty days after the operation she began to develop signs of gastro-intestinal disturbance with vomiting, distention, etc. Three days later dulness in the flanks developed. The abdomen was opened in the suprapubic region and a large pocket of thick, green, foul-smelling pus evacuated. The upper abdomen seemed to be walled off from this pocket. Six weeks later the patient's general condition had markedly improved, although there was still slight drainage from the abdominal wound.

Conclusions.—1. Splenic anæmia is a disease entity characterized by a definite symptomatology and pathological picture, and the so-called "Banti's disease" is its terminal stage.

2. In all probability the primary cause of splenic anæmia is a toxæmia, the origin of which is to be sought for outside the spleen itself, possibly in the gastro-intestinal tract, but the exact nature of which is as yet unknown. This toxin probably acts primarily or secondarily on splenic cells, causing an hypertrophy and increased activity.

3. This increased splenic activity is responsible for the anæmia probably through a decreased resistance of the red blood corpuscles. The icteric pigmentation is also due to an increased hæmolysis.

4. Although the thrombophlebitis of the splenic and portal veins is a frequent finding clinically, we believe, from our own experimental work and that of others, that it is not an essential factor in the etiology. If the theory of a primary toxin

is correct, we suggest that the blood coming from the spleen to the liver should be doubly toxic in that it contains not only the primary toxin, but that also elaborated by the splenic substance. To our minds it is the action of this doubly toxic blood that causes the endophlebitis of the splenic and portal veins with its consequent thrombosis.

5. In all probability these same toxic factors play the important rôle in the production of liver cirrhosis, although the mechanical factor of congestion of the portal system may be an additional cause.

6. Up to the present time treatment other than surgical has yielded only temporary benefit.

7. Splenectomy in the first and second stages offers us our only chance of permanent cure. The mortality is 12.5 per cent.

8. Splenectomy in the third stage will arrest the further development of the disease but will not cause a retrogression of the liver cirrhosis. In a few isolated cases of early cirrhosis permanent cure has followed removal of the spleen. In the past five years mortality following splenectomy when done in the third stage has been 56 ¼ per cent. The combination of splenectomy and Talma's operation should be the procedure of choice in this stage.

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EXACTNESS IN DIAGNOSIS AND CONSERVATISM IN TREATMENT OF RENAL CALCULUS.

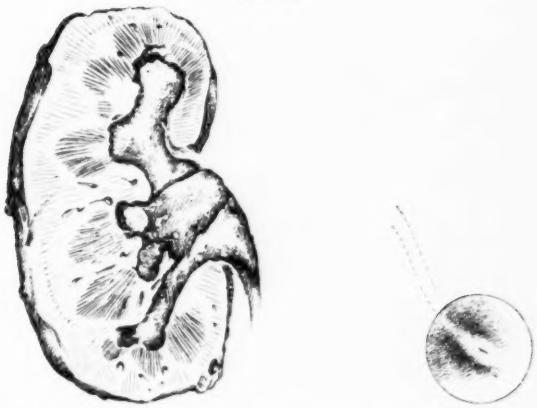
BY PAUL MONROE PILCHER.

In the past the efforts of surgeons to remove a calculus from the kidney have been accompanied by considerable traumatism to the organ itself. The kidney has been roughly handled, its parenchyma laid open, and the finger used to explore the various calyces and the renal pelvis. All of these procedures are unquestionably dangerous, and prompt the question: How can the surgeon avoid them and still remove the calculus from the kidney? In answering this question it may be said, first, that every means possible should be employed to establish an exact diagnosis, and that one should never operate upon a patient for renal calculus, basing his diagnosis on subjective symptoms alone.

So typical is the picture in many cases that few clinicians could fail of a correct diagnosis. However, when a surgeon has seen a number of patients suffering with the usual symptom complex, and yet has failed with the X-ray, cystoscope, or by operation to disclose a stone, he realizes that there are other conditions, some even entirely outside of the kidney, which may cause the symptoms. Gall-stones are seldom confusing; chronic appendicitis with a pericæcal veil of adhesions extending upward toward the kidney frequently is; perirenal adhesion, subcortical hemorrhages, acute congestion of the kidney causing a stretching of the capsule, and acute inflammatory diseases of the pelvis and parenchyma of the kidney are the most frequent conditions which simulate the symptoms of renal calculus.

Pain in the kidney not affected has frequently been observed. Personally, the writer has seen only one or two cases in which the excruciating pain of renal colic was referred to

FIG. 1.



Kidney with large branched stone filling pelvis and appearance of corresponding ureter opening. (Pilcher's Cystoscopy.)

FIG. 2.

Cystoscopic picture of ureter opening corresponding to a kidney containing a stone in its pelvis. (Pilcher's Cystoscopy.)

FIG. 3.

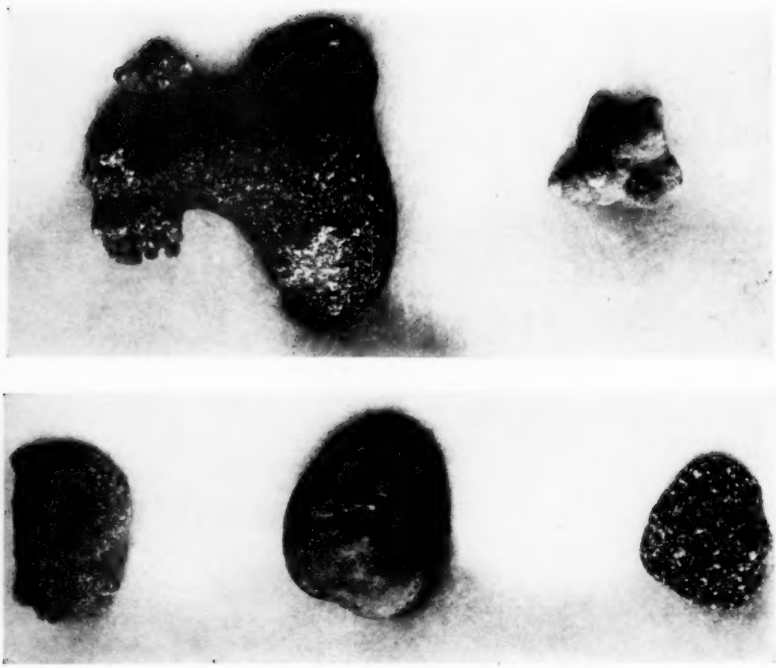


Plate showing variety of shapes and sizes met with in cases of renal calculus.

Stones which originated in the kidney, gave rise to repeated attacks of renal colic and were passed naturally from the urethra without operation.

the wrong side, but he has often noted that between or immediately following attacks of renal colic, from whatever cause, the sound kidney will ache and give more trouble than the diseased one. This probably is due to the compensatory hypertrophy or acute congestion arising as a result of its unusual activity during the renal spasm of its companion, aided by a renopelvic nervous reflex.

THE DIAGNOSIS.

Following out the practice that one should never operate upon a patient for renal calculus, from a diagnosis based on subjective symptoms alone, it may seem strange to specify that in every case a urinary examination should be made, but it is a fact that some surgeons will operate upon a kidney for supposed renal calculus, basing their opinion entirely on the subjective symptoms and physical examination alone. Moreover, it is not to be overlooked that there are cases in which all the typical symptoms of renal calculus are lacking, the affection not being discovered until much damage has already been done to the kidney.

In all cases of suspected renal calculus it is possible to determine by urinary examination: the presence or absence of blood in the urine; the presence or absence of pus in the urine, and its amount; the existence of a chronic or active nephritis.

The *cystoscope* is useful as a minor aid to diagnosis in these cases. The changes in the bladder are never sufficiently characteristic to be of value. The ureter catheter, with or without its waxed tip or metal point, is less useful than the Röngten ray, but may afford valuable confirmatory evidence.

The chief value of the cystoscope in renal calculus is to establish the functional activity of each kidney and, in connection with the X-ray, to determine the relation of the stone to the renal pelvis; to determine the presence of a calculus in the ureter or bladder, and to demonstrate the condition of the bladder. We are dealing strictly with renal calculus. Where a calculus is descending the ureter, the cystoscope is of greatest

diagnostic value. It helps us also to determine the size of the renal pelvis.

The Ureter Opening.—During the acuteness of an attack, the sphincter of the corresponding ureter opening appears tightly contracted; after an attack is over, the meatus is more relaxed, congested, and, in some cases, swollen. Where a chronic pyelitis is present the picture does not differ from that accompanying other descending infections. The bladder mucosa is not altered unless infection is present. As a rule there is just sufficient change in the appearance of the corresponding ureter opening to determine the side on which the lesion is.

Urinary Efflux.—One seldom has an opportunity of observing this during an acute attack. In one case examined by the writer the diseased side showed a slow dribbling of urine, while the normal kidney was delivering urine to the bladder in strong, rapid spurts, showing the reflex stimulation.

Functional Tests.—In almost all grades of renal calculus the functional activity is impaired. The degree of the disturbance depends entirely on the individual case. The tests are important in determining the indications for treatment. The disease affects equally the phloridzin, indigo-carmine, and phenolsulphonephthalein tests. The greater the amount of renal destruction, the more advanced will be the functional derangement.

X-ray Examination.—This is insisted upon in every case in order to determine the size, position, and number of calculi present. *We feel that a calculus which is so small as to be undetected by repeated X-ray examinations is probably small enough to pass out without surgical operation.* A large single shadow may be cast by one stone or by a group of stones massed together. A number of shadows arranged along a vertical or oblique line usually indicate multiple stones in the dilated calyces of a hydronephrotic kidney, and are probably contained within the shell of a kidney which should be removed.

The X-ray helps us materially to choose the type of opera-

tion suited to the particular case. For example, *an oxalate stone gives one of the densest shadows on an X-ray plate.* An oxalate stone is slow in its development, is usually situated low down in the renal pelvis, and is easily removed by pyelolithotomy. Therefore, if we have a patient who has repeated attacks of renal colic, or a fixed loin pain, with occasional hæmaturia, with a urine that is loaded down with oxalate of calcium crystals, in the absence of bacteria, and the X-ray shows a round-shaped stone below the free border of the ribs, one may be fairly certain that by a lumbar incision, a careful exposure of the kidney, and an incision of the renal pelvis on its posterior surface, the stone can be removed with little danger of a long-continued urinary fistula resulting. If, however, in a patient with the same symptoms and in whom the urinary findings are identical, we find an oval-shaped stone situated in the upper pole of the kidney, the shadow in the radiograph showing well above the free border of the ribs, it is fair to assume beforehand that the pelvis of the kidney is contracted by irritation, that the stone is situated high up within the kidney, and that it cannot always be satisfactorily exposed through the renal pelvis. Without attempting, then, in such a case to do a pyelolithotomy, a cortical incision limited in its extent will quickly and safely expose the stone and allow of its removal.

On the other hand, if the X-ray shows a triangular stone with the apex pointing inward or downward, in the presence of an alkaline urine, usually without hæmaturia and without a history of much pain or repeated colic, with an excess of phosphates in the urine, it is logical to conclude that the stone obstructing the pelvo-ureteral junction is composed of phosphates, and is the beginning of a dangerous branching stone which sooner or later will destroy the kidney itself. Such stones often have small branches which fracture easily and do not show on the X-ray plate. Under such conditions it is still often possible to remove the stone entirely through a restricted opening in the renal pelvis. If the stone when re-

moved shows that a portion of the calculus has been broken off from the main mass, the remaining fragment can sometimes be removed by incising the calyx, or, if necessary, by a cortical incision. At any rate, the existence of such a stone is an absolute indication for operation.

Again *the urate stones are very frequently multiple.* On an X-ray plate we will sometimes find a large stone blocking the ureter opening, and below this shadow are seen indications of a number of smaller stones in the kidney substance. Such a picture would indicate a considerable destruction of renal tissue with the formation of dilated calyces, in the bottom of which are contained multiple calculi which are lower down than the one at the ureteropelvic junction. Such a case might well be approached by a combined pelvo-ureteral and cortical incision, for it is practically impossible to remove all the small stones contained within a dilated calyx through an incision in the renal pelvis.

TREATMENT.—A patient who has had only one attack of renal colic is not necessarily a surgical case; one might safely say that *there are more renal calculi passed into the bladder and through the urethra than ever remain imprisoned in the kidney.* The danger in making such a statement lies in the fact that when a physician comes to accept it, he is apt to treat a primary renal colic medically, hoping there will be no recurrence, and he does not insist upon a complete diagnosis, thus exposing the patient to the danger of harboring a calculus which is too large to pass, and which will eventually destroy the kidney. Therefore, in all cases of renal colic, an X-ray examination should be made, and a careful watch be kept upon the urine.

The X-ray has been especially valuable in differentiating cases of renal calculus which are surgical. For example, we often see cases of recurrent attacks of renal colic due to the formation of small renal calculi which are essentially not surgical cases. As an example of this class of cases I may cite the following:

CASE.—A man forty-one years of age, had had rheumatism since childhood; for eight years had suffered from indigestion, with pain in the back, persistent headaches, and nausea. Two years ago he had an attack of renal colic on the left side, with vomiting and high fever; pain at first on the left side and then on the right side; has had recurrent attacks similar to this, with pain originating on both sides and passing along the front down along the course of the ureters, ending in the bladder. The patient has had three or four very severe attacks for which morphine was used; has passed many small stones of different sizes and shapes from the bladder.

Cystoscopic examination revealed both ureters thickened as they passed through the bladder, and both the right and the left ureter openings were somewhat dilated; there was no stone in the bladder; specific gravity of the urine, 1.033; total acidity of the urine, using a N/10 sodium hydrate solution, of 90 (normal being 35 to 40); therefore urine intensely acid, and contained many large uric acid crystals and clumps of crystals; also contained blood, but no pus. Two calculi, which were passed the day previous, were fairly large and rough, typical uric acid calculi, the larger being nearly three-eighths of an inch in length and three-sixteenths of an inch in width. A careful examination of these calculi which were passed showed a broken surface, as if these pieces had been broken off from a larger stone. We had all the symptoms of a large calculus in one or both kidneys, from which occasionally small pieces would break off and pass out; and yet when an X-ray examination was made no calculus could be found in either kidney, either ureter, or in the bladder.

If the calculus is small and is evidently descending, it should be allowed to work its way down, if possible. When it arrives at the vesical portion of the ureter it may be necessary to inject oil around it, dislodge it by instruments, or enlarge the ureter opening to facilitate its escape.

When, however, the stone in the kidney is too large to pass, it should always be removed by operation even if active symptoms of its presence are lacking, providing the kidney is still functionating normally and the second kidney is not diseased.

The three methods now employed for accomplishing this are: pyelolithotomy, nephrotomy, and nephrectomy.

Usually when the X-ray shows the stone contained within the substance of the kidney itself, the cortical incision alone is indicated.

The aim of the surgeon is to remove the stone with as little injury to the kidney as possible. The old fear of persistent urinary fistula following incision of the pelvis of the kidney is no longer present, for, as I will show later, the more advanced methods of operation have eliminated this.

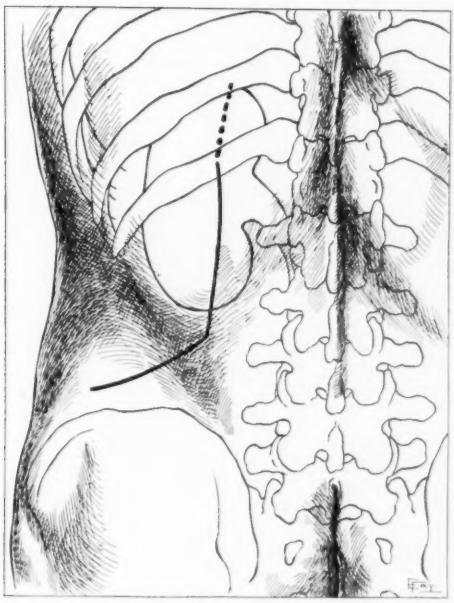
I mention these facts and have tried to show how fairly accurate conclusions may sometimes be drawn from a careful study of the symptoms in combination with radiography, in order to emphasize the fact that they have a distinct bearing upon the character and safety and completeness of an operation for renal calculus. The subjective symptoms draw our attention to the condition. The urinary examination in combination with radiography and cystoscopy establish and define the exact diagnosis.

CHOICE OF OPERATION.

Our choice of operation is, first, pyelolithotomy; second, nephrotomy; and third, nephrectomy. Broadly speaking, *pyelolithotomy is indicated* in a case where the stone is situated wholly within the pelvis of the kidney, in the first portion of the ureter, or in the lower calyces of the kidney, provided the pelvis is dilated. It is *contraindicated* in a kidney which is bound down by strong adhesions so that it cannot be brought well into the wound; also where the fatty fascia surrounding the renal pelvis is friable and infiltrated with inflammatory exudate; *it is difficult* in those cases where a short pedicle is implanted high within the kidney. The short renal pedicle is not always a contraindication, provided the kidney can be well exposed. The operation is apt to be difficult in stout patients, but as one becomes more expert in operating upon the kidney it is possible to perform a pyelolithotomy without delivering the kidney into the wound.

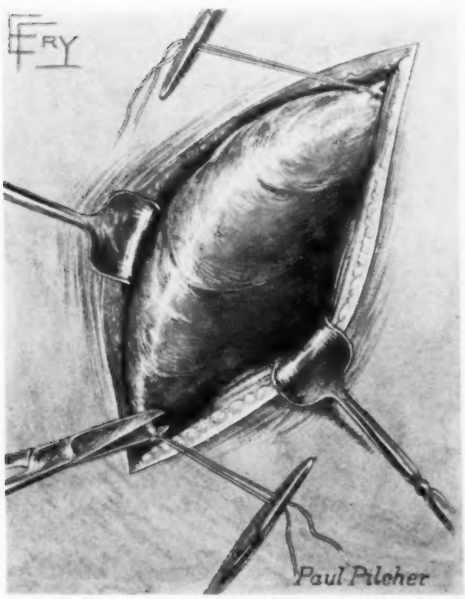
Nephrotomy is indicated where pyelolithotomy cannot be performed, providing the parenchyma of the kidney has not

FIG. 4.



Line of incision for exposing kidney.

FIG. 5.



Freeing the kidney in order to bring it more freely into the wound. It will be found that there are generally vessels entering the kidney both at its upper and lower pole. In order to prevent hemorrhage from those tissues, whether they contain vessels or not, they are tied with catgut ligatures and divided.

been extensively destroyed, and providing suppurative pyelonephritis is not present. It is the writer's belief that the kidney which is the seat of a suppurative pyelonephritis should always be removed and never be incised, if the functional capacity of the second kidney will permit of it. It is a mistake to think that the shell of a kidney is of use to the human economy; it is rather a great source of danger, and will embarrass the second kidney, even if that, too, is partially destroyed.

The technic of pyelolithotomy is very simple, but the observances of general principles involved in the various steps of the operation are important to its ultimate success.

TECHNIC OF PYELOLITHOTOMY.

Incision.—The writer prefers an incision which begins two and one-half inches from the spines of the vertebra at a level with the last rib. It is continued straight downward to within an inch of the crest of the ilium, and is then carried forward parallel to the crest of the ilium. Considerable care is taken in making this incision. The incision parallel to the spines of the vertebra does not cut any muscle fibres, and the continuance of this "flail" incision divides the fibres of the external and internal oblique muscle (Fig. 4).

One of the most important details influencing the success of the operation of pyelolithotomy is a good exposure of the field of operation, and the original incision should be completed before the kidney is exposed, for in this way the muscles are best conserved. The kidney then is exposed in the usual way, is dislocated from its bed and brought into the wound, and a careful inspection of the kidney and pelvis is then made. If it is not possible to deliver the kidney, the case is one unsuited for pyelolithotomy, for, as I have stated elsewhere, the traumatism consequent to the delivery of the kidney which is bound down by dense adhesions of inflammatory exudate is more harmful than a clean cortical incision through the substance of the kidney.

Basing our steps on the diagnosis already established, we may meet with *three distinct problems: First,* one in which the

stone, usually an oxalate stone, is contained well within a renal pelvis of a normal size, but whose walls are somewhat thickened by irritation; *second,* a renal pelvis which is very considerably dilated, due to the lodgement of a movable stone at the pelvo-ureteral junction; this stone can be dislocated upward into the dilated renal pelvis; *third,* a fixed stone at the pelvo-ureteral junction, usually with a constriction above it which prevents it from being dislocated (see Fig. 12).

In the first instance the technic of the operation is as follows (Figs. 6, 7 and 8):

The fatty fascia covering the renal pelvis is incised along the line parallel to the vertebral spines, thus exposing the renal pelvis. Retractors are used to more freely expose the walls of the renal pelvis, which is incised in a line diagonal to the line of incision of the fatty fascia, and the stone is exposed and removed. If feasible, the pelvic wall is closed with a running catgut suture, and the fascia flap is closed by a second layer of running sutures over the first. In this way we will, in the great majority of cases, obtain a primary union in the wound, even where a moderate grade infection exists.

Where it is impossible or not feasible to suture the renal pelvis it may be left open without fear of a urinary fistula following, *providing the ureter is unobstructed.*

In the second instance *where the pelvo-ureteral junction is occupied by a movable calculus* and the pelvis is considerably dilated, an incision should be made through the fatty fascia overlying the lower portion of the renal pelvis, the stone dislocated upward from its position, an aspirating needle introduced into the pelvis and the fluid removed; the pelvis then incised and the stone removed, and the wound closed as in the first instance (Figs. 10 and 11).

In the third case *where the stone is impacted and immovable at the pelvo-ureteral junction,* a curved incision is made in the fatty fascia, exposing directly the site occupied by the stone; a vertical incision is made across the neck of the constriction of the pelvis, exposing the stone which is removed through this opening, and then the upper and lower angles

of the wound are drawn together and the wound sutured in such a manner that the line of incision becomes horizontal instead of vertical, thus causing a dilated portion of the ureter where a stricture previously existed (Figs. 12 and 13).

These in general, then, are the points in operative technic for conservative work on renal calculus. In a relatively large number of cases pyelolithotomy may be carried out, and we can feel sure that the wound following the operation will heal by first intention. In a certain number of cases the more conservative operation must be replaced by the cortical incision, the indications for which are fairly well defined; but lastly, it has been our experience that *it is a very dangerous experiment to try any conservative operation upon a kidney which is the seat of a suppurative pyelonephritis,* whether it is complicated by stone formation or not.

A presentation of this subject should not be attempted without acknowledging our indebtedness to Fenwick, of London, and William Mayo,[1] of Rochester, for the work they have done in advancing this branch of renal surgery.

ILLUSTRATIVE CASES.

CASE I.—*Bilateral renal calculi; chief symptoms referred to left kidney owing to descent of calculi into ureter; large branched calculus filling pelvis and calyces of right kidney; removal by pyelolithotomy.*

Admitted to the Pilcher Hospital February 9, 1913. Twelve years ago ovaries were removed, together with multiple small fibroid tumors of the uterus which were supposed to cause irritability of the bladder. Ten years ago had violent attack of colic of the bladder, characterized by violent pain low down in the abdomen and inability to urinate. These symptoms gradually improved and patient was in good health. June 15, 1912, she began to have a sense of discomfort referred to the left side and back, evidently renal; then an acute renal colic referred to the left side, which lasted for three hours, and caused much prostration; pus and blood in the urine. Following that for three or four days had similar attacks, but less severe. Now urinates every hour,

[1] MAYO, WILLIAM J.: Surg., Gyn., and Obst., April, 1910, pp. 363–365.

night and day; is never free from desire to urinate. Paroxysms of pain start in the region of the left kidney, pass down the left side to the bladder. Need of urination every few minutes at such times. Later the pain was severe in the bladder.

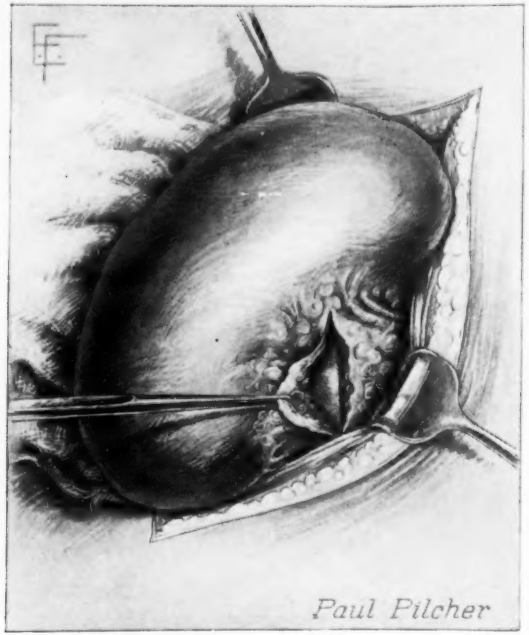
Cystoscopic examination, September, 1912, showed the bladder to be normal; no obstruction in the ureters; urine from left kidney contained blood. Examination of the bladder urine showed pus and blood to be present.

X-ray examination by Dr. Eastmond in September showed a branched stone in the right kidney and multiple stones in the left kidney. An X-ray examination by Dr. Caldwell, of New York, some weeks later, showed left kidney clear, an oblong stone in the left ureter near the bladder; branched stones in the right kidney.

In the history given there was no complaint referable to the right kidney and yet the X-ray shows in it a collection of stones which is very striking. A more close cross-examination of the patient brings out a history of previous symptoms pointing to the right kidney. These are not of recent date, but more probably deal with that period when the original stone was forming and small bits of stone or large collections of crystals were passing along the ureter (Fig. 14).

At the present time attention is drawn toward the left kidney because a stone has entered the ureter and is making its way downward to the bladder. The first attack of pain is evidenced when the stone engages at the ureteral intake. This portion of the ureter is very dilatable and with the continued spasm of the walls of the renal pelvis and the added dilatation due to the blocking of the ureter the stone is gradually forced downward, being arrested either at the brim of the bony pelvis or, passing this, engaging at the ureterovesical junction. So we may explain the symptoms in this case. The relatively small cylindrical stone with blunted ends shows clearly in the picture. This X-ray shadowgraph tells its own story. It demonstrates most strikingly the difference between the shadow of a ureteral stone and that of a phlebolith. Many opinions to the contrary, the relative positions of the stones are quite characteristic. The pelvic ureter seldom varies its position and is far nearer the median line than the veins which contain phleboliths. Then again, the phleboliths are usually multiple, round and clear-cut, while the edges of an impacted stone are blurred by the inflammatory exudate occasioned by its pressure in the ureter; ureteral stones are usually single.

FIG. 6.

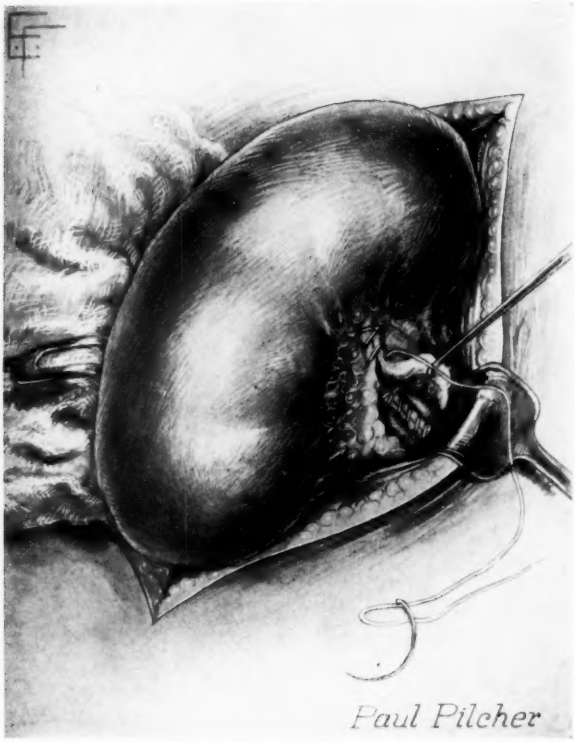


Showing the first step in exposing the renal pelvis after the kidney has been mobilized and brought into the wound; the posterior surface of the kidney is shown. A vertical incision is made through the fatty fascia surrounding the renal pelvis, exposing the external wall of the renal pelvis.

FIG. 7.

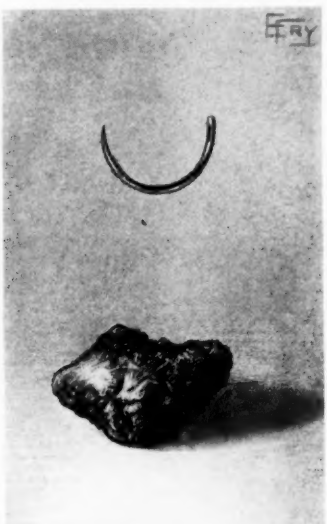
Showing the second step after the pelvis of the kidney has been exposed by an incision through the fatty fascia. A second incision is made through the wall of the pelvis, cutting down upon the stone directly, if possible. The stone is expressed through this opening and the incision in the renal pelvis is closed by a running suture of silverized catgut.

FIG. 8.



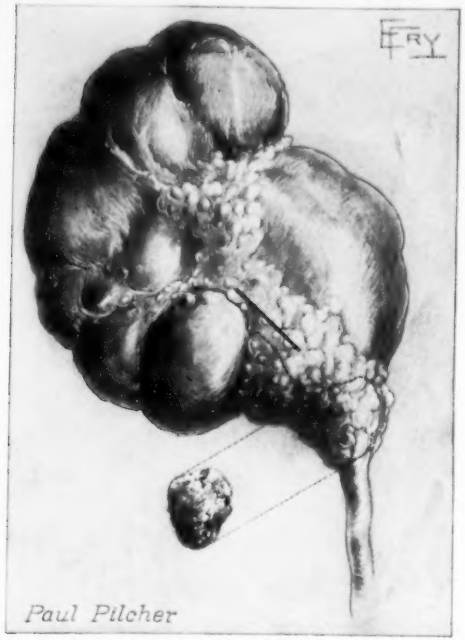
Last step showing the pelvis of the kidney sutured by a running catgut suture and the fascial flap being sutured over this. The two lines of suture only cross at one point.

FIG. 9.



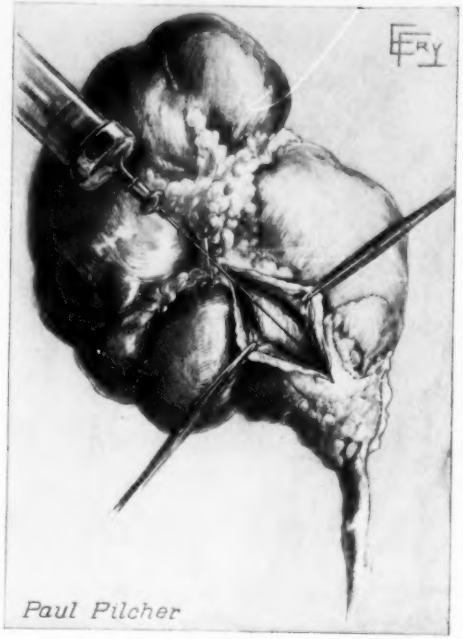
A small round well curved needle is used to suture the opening in the pelvis of the kidney and the fatty fascia. Below is shown a stone removed from the kidney pelvis by pyelolithotomy.

FIG. 10.



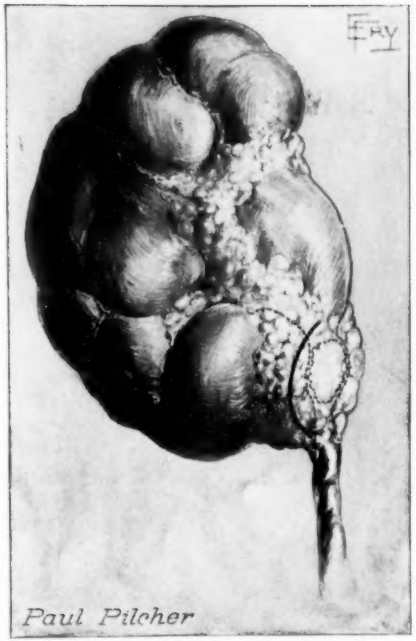
The pelvo-ureteral junction is occupied by a movable calculus, and the pelvis is considerably dilated. The *first step* is the dislocation of the stone upward into the dilated renal pelvis; the *second step*, an incision made through the fatty fascia over-lying the lower portion of the renal pelvis, exposing the wall of the pelvis.

FIG. 11.



In a case where a movable calculus occupies the pelvo-ureteral junction. Second step, after the exposure of the wall of the renal pelvis an aspirating needle is introduced and the hydronephrotic fluid is removed. The wound is closed by a running silverized catgut suture, and the fatty fascia is sutured over the first suture line by a continuous suture.

FIG. 12.



Showing the stone impacted and immovable at the pelvo-ureteral junction. In this case a curved incision is made through the fatty fascia, exposing directly the site occupied by the stone.

FIG. 13.

Second step in a case where the stone is impacted and immovable at the pelvo-ureteral junction. After the site of the constriction has been exposed a vertical incision is made across the neck of the constriction, exposing the stone directly, which is removed through this opening. The smaller diagrams show the manner of closing this wound; the upper and lower angles of the wound are drawn together and the wound sutured in such a manner that the line of incision becomes horizontal, instead of vertical, thus causing a dilated portion of the ureter where a stricture previously existed.

The right kidney appears perfectly normal in conformation, its outline smooth and regular. It contains three distinct calculi and possibly a fourth which is overshadowed by the lower mass. Naturally the kidney is enlarged but the shadowgraph would indicate no area of destruction, its density being equal throughout. Also, if there was obstruction of the ureter at its inlet, a hydronephrosis would result and this would be shown by irregularities in the outline of the kidney. Studying the shadowgraph, therefore, we conclude that the right kidney is in its normal position, that its pedicle is not very long, that its pelvis is filled with a mass of calculi, and that these lie well imbedded in the pelvis and do not move downward and engage in the ureteral inlet.

Second, that there is a small cylindrical stone in the left ureter at the point where the ureter enters the bladder. The fact that the symptoms referable to the left kidney have abated is significant of the fact that the urine is passing the obstruction at present; further, that the stone may be removed in two ways, (1) by the vaginal route, and (2) by the transperitoneal route.

The indication in the present case is to remove the obstruction from the left ureter; later, to perform a nephrolithotomy in the right kidney.

In performing a vaginal ureterotomy it might be preferable to do the same transperitoneally in order to secure rapid healing of the wound of the ureter by the aid of the peritoneal exudates. Stripping up the peritoneum from off the ureter in exposing the stone should, therefore, be avoided, although it seems the logical procedure. An extraperitoneal ureterovaginal fistula is too easily established.

On October 9, 1912, another X-ray plate taken by Dr. Imboden showed the kidney shadows approximately normal in size, outline, and position. The right kidney contained three irregularly shaped stones, the two larger ones measuring 1¼ inches long and the shortest one measuring ¼ of an inch. There was also low down in the left ureter another stone. In January, 1913, the patient had another attack of discomfort in the region of the left kidney. This stopped suddenly and after that time the patient felt much better. February 8, 1913, another set of pictures was taken by Dr. Caldwell, who reported that the plates showed two large calculi branching into the calyces of the right kidney and a third calculus much smaller opposite the lower one of these two;

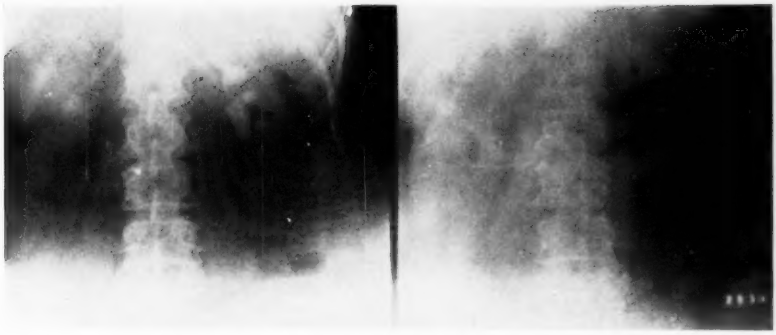
the lower of the two larger calculi having two projections not shown without the stereoscope. These extended anteriorly. There were in addition small calculous patches in the neighborhood of the upper one of the larger stones. The shadow of the calculus shown in the left ureter at the first examination made in December had disappeared and it was thought that the calculus had passed.

Functional test made February 10, 1913, showed both kidneys to be normal in function. Bladder urine, 1.016; strongly alkaline; moderate amount of albumin; traces of blood and large quantities of muco-pus with triple phosphate crystals. Urine from right kidney contained pus and blood. Urine from left kidney some blood, no pus, and an excess of large lymphocytes.

The problem, then, had reduced itself to the condition of the large branched stone in the right kidney (Fig. 15). We did not feel that pyelolithotomy was impossible even in the presence of such large calculi as these, and we therefore determined to try it in this case.

Operation: Pyelolithotomy of Right Kidney.—February 11, 1913, by Dr. P. M. Pilcher, ether by Dr. W. C. Woolsey. The usual operation was made for exposing the right kidney, freeing the attachments of the last rib in order to retract it upward. It was possible to reach the renal space without cutting across any of the muscle structures. The kidney was freed and brought up into the wound, the fascia and fatty tissue dissected away from the pelvis and a ¾ inch incision made through the pelvic wall which was found to be thickened. The finger was passed through this opening and gradually the stone occupying the lower part of the kidney was freed and removed with forceps. This stone measured one inch in length and ¾ of an inch in width and was branched, fitting into the calyces. A small fragment which had been previously broken off was removed and then the upper large branched stone was gradually freed by pushing the wall of the dilated calyces away from the stone and was delivered through the opening. This upper stone measured 1¼ inches in length, at its base was one inch across, at its middle point was ⅜ inch across and at its upper end was ¾ inch across. By the finger introduced through the opening in the pelvis a search was made of the remaining portions of the pelvis, but no other concretions were found. The opening in the renal pelvis was closed by a single running suture of silverized catgut. The kidney was replaced. A cigarette drain was carried down to the suture line;

FIG. 14.

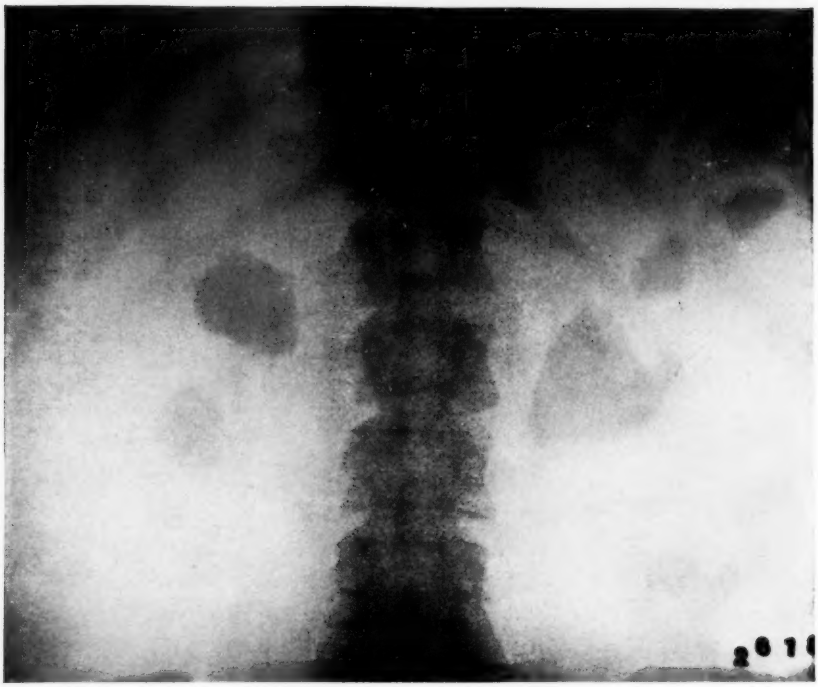


Stereoscopic X-ray plate showing calculi in Case I. The two distinct masses represent the stones in the right kidney. The outline of the kidney can be seen and is only slightly larger than normal.

FIG. 15.

Photograph of a reconstructed model, showing the stones in place after their removal from the kidney. A typical pyelolithotomy was done and through the small incision in the renal pelvis, as indicated in the photograph, the stones were successfully removed from the kidney without any injury to the kidney tissue itself.

FIG. 16.



X-ray plate of kidneys in Case II. In the left kidney are seen three masses, one at the pelvic outlet, one in the lower pole, and one in the upper pole. In the right kidney region are seen a mass of calculi, the largest one of which occupies the pelvic outlet. It will be seen by comparing this stone with the vertebra that it is of enormous proportions. By referring to Fig. 17, the stereoscopic picture, the relatively larger size of the kidneys can be seen.

a rubber tissue drain carried to the opposite side of the kidney, and a rubber tissue drain to the lower pole of the kidney. The wound was closed by layer sutures of chromic catgut with the exception of the point through which the three drains were brought out. Operation occupied an hour.

Post-operative History.—There was no leakage from the wound until about four days after the operation, at which time some urine leaked through the wound. This continued for about two weeks. Patient made a perfect operative recovery, and the wound healed entirely in about three weeks.

After History.—About three months after the operation patient had some renal colic on the right side, which passed off quickly. Since that time she has been perfectly well and has had no further symptoms of calculous disease on either side.

A model was made of the kidney after the operations with the stones in place, showing the opening in the pelvis through which the stones were extracted (Fig. 15). This case demonstrates that the operation of pyelolithotomy may be practical, even with a large branched stone.

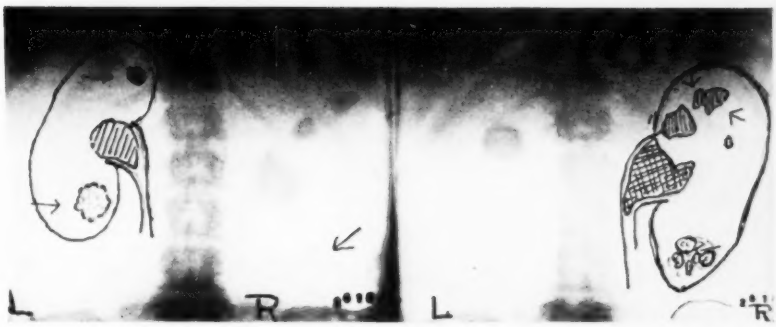
CASE II.—*Hæmaturia; multiple renal calculi in both kidneys; pyonephrosis of both kidneys.*

Admitted to the Pilcher Hospital March 14, 1913. Patient referred to us by Dr. Weadon, of Bridgeport, Conn. She presented herself suffering from continued and exhausting hæmaturia, with frequent urination and a very marked pyuria with occasional attacks of severe renal colic on both sides. Thirteen years ago she was delivered of a child. Since that time she has suffered from three miscarriages. Following her child's birth she was in poor health for some time, headaches, distress in the back, general malaise. Ten years ago she was very sick, had chills, fever, and pain in the region of the right kidney. Since that time she has had more or less backache about the level of the second lumbar vertebra on both sides. Suffers from headaches, nausea, in the morning a general feeling of being only half well. Periods, etc., normal. Some years ago an operation was done in the right lumbar region to expose the kidney, but no disease was proven at that time. She had been under treatment for months for supposed uterine trouble. Cystoscopic examination disclosed a fairly normal bladder without any distinct areas of inflammation. The right ureter was catheterized and urine containing a large amount

of pus was obtained from the right kidney. The left ureter was catheterized and some urine containing less pus than that from the right kidney was obtained. There was emitted, however, from the left ureter opening large clouds of thick mucus. While the catheter was in place, the mucus oozed out by the side of the catheter into the bladder. The bladder capacity was more than 12 ounces and there were no lesions suggestive of tuberculosis; each kidney was found to be functionating equally. The right kidney was secreting a relatively large amount of pus and the left kidney a small amount, estimated at five times the amount of pus coming from the right kidney as from the left. Bacteriological examination of the pus from both kidneys showed a pure culture of Bacillus pyocyaneus. A vaccine was made from these cultures. Each kidney pelvis was drained and a drachm of 5 per cent. argyrol was injected. Phthalein test was made of the whole urine and it was found that a very small per cent. of the phthalein was excreted in the first hour, too little to be estimated. Methylene blue was also used, and only a very slight amount was excreted by both kidneys.

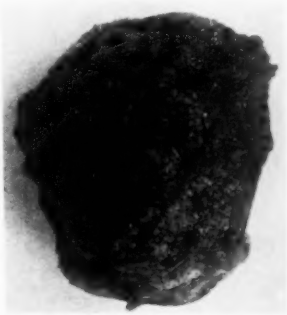
X-ray pictures were taken by Dr. Caldwell, of New York, and showed that the pelvis of each kidney was blocked by a large wedge-shaped stone. A smaller stone was in the lower pole of the left kidney and there was also one in the upper pole near the spine, the stone in the right kidney being the larger and the stone in the left kidney being half that size. The outline of the left kidney showed it to be fairly normal in size; its upper pole being occupied by a small round calculus and its lower pole by a collection of concretions which formed a calculus of considerable size. The right kidney was seen to be very greatly enlarged, being twice as large as the left kidney, and beside the large stones at the outlet of the pelvis there were two smaller stones in the calyces in the upper half of the kidney and a collection of concretions and small trash in the lower pole of the kidney (Figs. 16 and 17). The problem, then, which presented itself was primarily one of obstruction at the pelvic outlet of both kidneys with advanced destruction of the secreting tissues of both kidneys. However, as long as there was an obstruction at the pelvic outlet, it would be improbable that any improvement would be possible, therefore it was decided to relieve the obstruction at the pelvis of the more normal kidney, believing that, if this could be accomplished safely, the left kidney would re-establish its normal functions to a con-

FIG. 17.



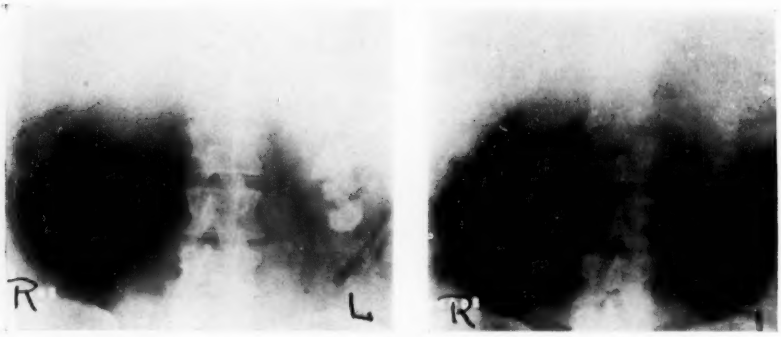
Stereoscopic X-ray of the kidney regions in Case II. The writer has outlined in ink his interpretation of the position of the various stones in the kidney. On the left side the pelvic outlet is occupied by a large stone. In the lower pole of the kidney is seen an irregular concretion, and judging by its relative circumference and the very slight shadow which it casts on the X-ray plate, it is estimated that this mass is made up of calcareous deposits on the wall of a dilated portion of the kidney and is not a free stone. The same is true of the single shadow in the upper pole of the kidney. The right kidney is seen to be much dilated and its pelvis blocked by a large stone with a series of stones in the upper pole, and the lower portion of the kidney is occupied by a mass of concretions evidently attached to the pelvic wall by a large hydronephrotic area. The problem in this case was to relieve the patient from advancing uræmia and a continuous exhausting hæmaturia. It was decided to do a pyelolithotomy of the left kidney, which was successfully carried out.

FIG. 18.



Showing a stone which was removed from the pelvis of the left kidney (Fig. 17). This calculus was made up of phosphates and uric acid crystals, and was crushed easily in removing it so that its shape is somewhat faulty.

FIG. 19.



Stereoscopic view of the kidney regions in Case III. Large masses of calcareous material are seen filling the various calyces. The portion occupying the pelvic outlet is easily determined. The only feasible operation in such a case is probably nephrectomy, but no attempt at pyelolithotomy should be made.

FIG. 20.

Kidney removed from Case IV, showing the pelvic outlet blocked by a stone and all the kidney tissue destroyed by a hydronephrotic process with multiple calculi. Only nephrectomy could be recommended in such a case.

siderable degree and at some later date a similar operation might be performed upon the right kidney. It was felt that if no attempt was made to relieve the obstruction in the right kidney it might result in a complete disorganization of that kidney, while the chances of safely removing the obstruction and stone of the left kidney were far greater, and, if only one operation could be done, the best operation was the relief of this obstruction on the left side; therefore, under ether anæsthesia the operation was undertaken.

Operation: Pyelolithotomy.—March 22, 1913, by Dr. P. M. Pilcher, ether anæsthesia by Dr. Frank Sammis.

The usual straight lumbar incision was made with the arm extending forward along the crest of the ileum. The kidney was exposed and found to be densely adherent to the surrounding tissue, especially at its upper pole. The area at the junction of the middle third of the kidney showed marked evidences of destruction of the kidney tissue within the organ, and there was great danger of tearing off the upper pole of the kidney. With considerable difficulty the kidney was freed and its posterior surface brought up into the wound, the pelvic outlet exposed, the pelvis incised, and a large stone removed from the kidney pelvis without injury to the kidney tissue. The stone was as large as an English walnut. The opening in the pelvis was sutured with silverized catgut suture. Kidney replaced; cigarette drain to pelvis and rubber tissue to the lower pole. Wound closed around these drains. Patient stood the operation well. During the first 24 hours she passed about 45 ounces of urine.

Further History.—There was no leakage from the wound in the pelvis and the incision healed by primary union, excepting at the points where the drains led out. After the first five days of satisfactory post-operative course there were evidences of renal insufficiency. She developed a gastric type of uræmia evidenced by frequent uncontrollable vomiting and a gradually decreasing amount of urine excretion. This continued until death supervened twelve days after the operation. There were none of the ordinary evidences of uræmia other than the vomiting and the suppression of urine.

In considering the case afterwards we still felt justified in attempting some relief to the patient, although we were unsuccessful. In the first place, she was losing large quantities of blood and was suffering both from her frequency of urination and from

pain. She was practically an invalid. At the same time the evidence which was presented showed us that both kidneys were very far below par, both in responding to the phenolphthalein test and the methylene blue test. After removal of the stone from the pelvis the reaction of the patient was all that could be asked. She felt well, passed a normal amount of urine, and was free from fever. However, after a few days the secretion of the kidneys failed and the patient died of renal insufficiency.

CASE III.—*Pelvis and calyces of left kidney filled by calculus material.*

Patient, aged sixty-one, referred to us by Dr. Heebe, of Brooklyn. For a number of years has had typical attacks of renal colic referred to the left side. About twelve years ago he passed a number of small calculi. In September, 1909, patient had an attack of tenesmus and a fairly large calculus became lodged in his urethra. This was removed through an endoscope. Since that time has suffered constantly from a bearing down pain in the bladder, especially when constipated. There has been soreness ever since, and patient has much backache over both kidney regions. Urine shows no albumin, some leucocytes and triple phosphates. Cystoscope shows chronic cystitis of the base of the bladder; no residual urine; urine as passed proved to be alkaline. Second examination made after treating the bladder, swelling disappeared and both ureter openings were found to be normal. No stones in the bladder. Urine showed a large amount of pus with fair amount of albumin and relatively numerous renal cells.

X-ray by Dr. Caldwell shows a very large collection of calculous material in the left kidney, which fills the pelvis of the ureter and has branches into six or eight calyces, most of which are enlarged. The kidney showed itself somewhat enlarged. The right kidney shows nothing unusual, except that it is weaker than the left.

This case has not as yet been operated upon, and it is questionable whether the left kidney can be saved or not. The operation of pyelolithotomy is not to be thought of in this case on account of the extensive amount of calculous material filling the various calyces. The indication is to expose the kidney, remove the calculous material, and then determine the worth of the remaining kidney tissue. From the X-ray the pelvic outlet can be easily seen high up (Fig. 19).

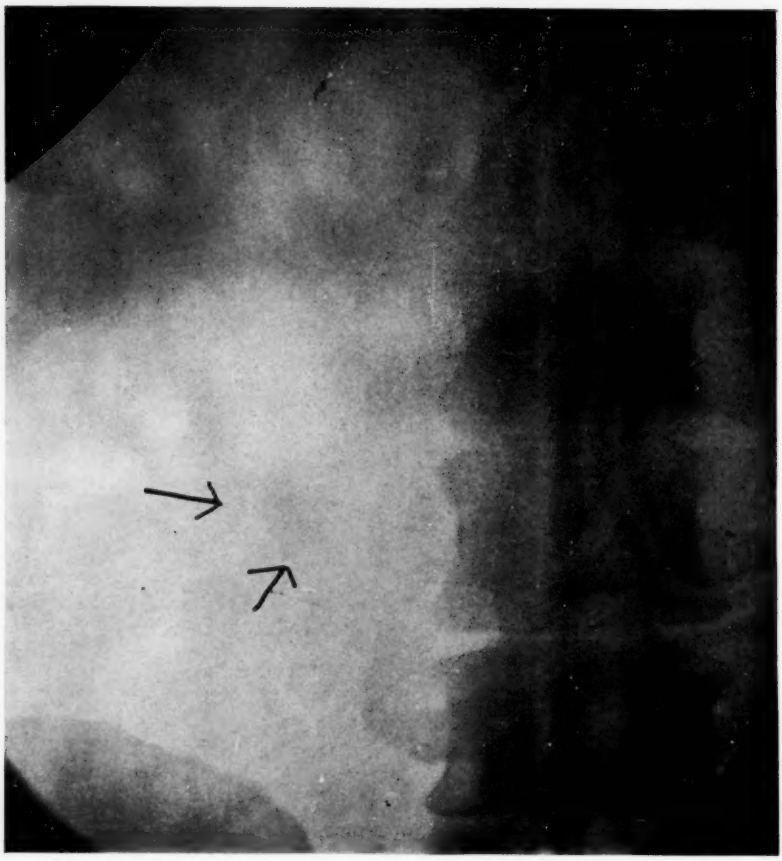
FIG. 21.

X-ray picture of the kidney region in Case V. It is seen that the calculus occupies the pelvic outlet and there is one small extension in the calyx. The stone is seen well below the last rib and is, therefore, easily accessible and was removed by pyelolithotomy with primary union in the wound.

FIG. 22.

X-ray picture of kidney region in a case of renal calculus in which all the symptoms of intense renal colic were referred to the right kidney. The cystoscopic findings showed the left kidney to be affected and an X-ray picture showed the calculus occupying the pelvic outlet in the left kidney. The X-ray shows the stone low down well below the free border of the ribs and therefore easily accessible and removable by pyelolithotomy. This was done and patient made an uninterrupted recovery from the wound.

FIG. 23.



Another case of calculus occupying the first portion of the ureter, the shadow showing it to be well below the free border of the ribs and therefore accessible to pyelolithotomy. This patient is yet to be operated upon.

CASE IV.—*Multiple calculi in right kidney, with pyonephrosis to a degree practically destroying the kidney; other kidney sound; nephrectomy.*

A young woman who had suffered from intermittent attacks of renal colic on the right side, at which times there would be fever, pain, and general prostration. History dates back to the birth of her child three years previously. The cystoscope showed large amount of pus coming from the right kidney. The left kidney was normal. When the right kidney was exposed it was found to be a mere shell containing numerous calculi. The indication in this case was for nephrectomy without question (Fig. 20).

CASE V.—*Single calculus in the pelvis of the right kidney; left kidney sound; calculus removed by pyelolithotomy.*

A woman about twenty-eight years of age. Four years ago was operated upon for supposed appendicitis on account of indefinite pains in the right side. The appendix was removed, but the trouble still persisted. One year ago urine showed a large amount of albumin during pregnancy. Some pus in the urine, which has never cleared up. She has had very considerable bladder irritability, with frequency of urination. Chief complaint now is bladder irritability with urine containing pus and blood. Pathological examination showed pure culture of Streptococcus albus. Bladder urine showed pus, oxalate of lime, and a few red blood-cells. Further questioning elicited the history that she has suffered from so-called attacks of indigestion which centre in the right side in the region of the right kidney.

Cystoscopic examination showed congestion of the bladder. Both ureter openings normal, with some congestion near the right ureter opening. Catheterized urine from the right kidney very profuse and watery, contained pus. Catheterized specimen from left kidney perfectly clear, very profuse. Both kidneys very excited.

X-ray examination showed a sheath-shaped calculus in the pelvis of the right kidney (Fig. 21). Its size and position on the X-ray plate showed that it was an ideal case for pyelolithotomy. The stone was removed at the Long Island College Hospital by pyelolithotomy. Patient made an uninterrupted recovery.

TRANSPERITONEAL RESECTION OF A DIVERTICULUM OF THE BLADDER.

BY EDWIN BEER, M.D.,

OF NEW YORK.

From the Genito-Urinary Surgical Service of the Mount Sinai Hospital.

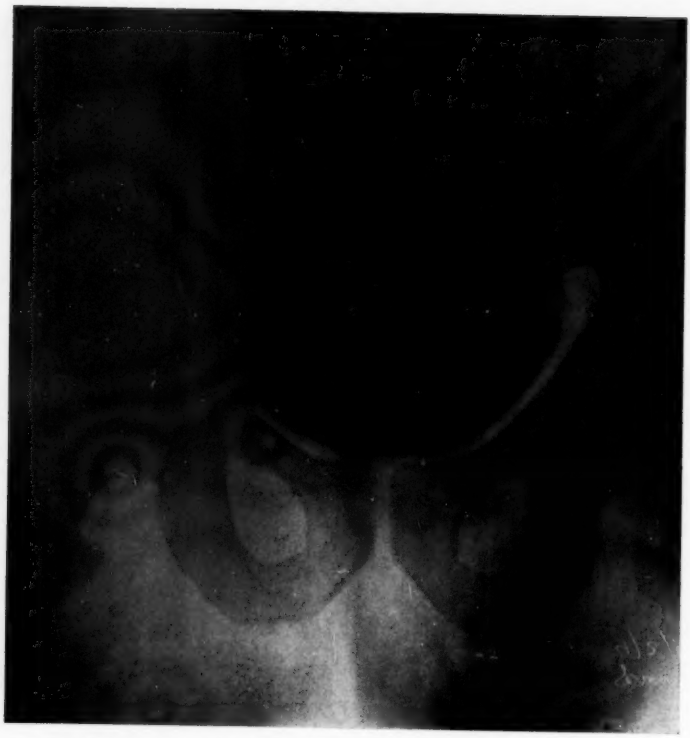
ACCORDING to the excellent review of Wm. Lerche, in the ANNALS OF SURGERY, lv, 285, 1912, there are only 15 cases of excision of diverticula of the bladder recorded up to that date. Since then four more cases have been added during the current year, two by Chute, one by Bergener and one by Bryan. Of all these cases only four were approached by the intraperitoneal route, and most of these in a somewhat different manner from that employed in the case to be reported. The favorite method of approach has been the extraperitoneal route, pushing the peritoneum back from the bladder, and then cutting off the diverticulum or invaginating it into the bladder and then cutting it off through an opening in this viscus. To these four cases I wish to add a fifth, in which I was able to remove by the transperitoneal route without any great difficulty, perhaps the largest diverticulum that has been removed, and which went on to recovery without any accidents. As the method used in this case has some advantages, due to the better exposure and the more ready access, I have deemed it advisable to report it *in extenso*.

CASE I.—Male, thirty-five years. Well until ten months before admission to the hospital. At that time he says he caught cold, following which he had a urethritis. Discharge from urethra lasted four weeks, but the urine continued cloudy, and showed a sediment on standing. It had a foul odor. There was no dysuria, no hæmaturia, and no increased frequency. Seven months later he developed a swollen testicle on the right side. This lasted two weeks, and then disappeared. Three weeks before admission this testicle again became swollen. Throughout this time the urine remained as above.

FIG. 1.

Diverticulum of bladder. X-ray with collargol. Before excision.

FIG. 2.



Diverticulum of bladder. X-ray with collargol. After excision.

On admission the patient showed an undue pallor and a general lack of tone, probably due to the toxic absorption from his urinary tract. His physical examination showed no organic or nervous disturbance. The right testis was somewhat larger than the left, and there was a small nodule in the right epididymis.

There was slight tenderness in the right costovertebral angle. Cystoscopic examination showed just behind the right ureter meatus, which was normal though displaced toward the neck of the bladder, a large diverticular opening, into which the cystoscope entered readily. The interior of this cavity was easily inspected, and its mucosa found to be inflamed, and covered with pus, especially in the dependent parts. Just mesial to the orifice of the diverticulum and behind the interureteric line there were two small crypts, which just admitted a catheter, but from which no stream was emitted. The left ureter meatus was normal in appearance, and just behind it and a little to the left there was another small diverticulum, situated in the same relative position as the enormous one on the right side. The trigone was very much inflamed. No third ureter could be found. After careful washing, the ureters were catheterized and clear urine obtained from the left, but slightly turbid (pus) urine from the right. Indigo carmine was excreted in good concentration from both sides in 20 minutes.

From the foul smelling urine only colon bacilli were recovered. The residual urine varied from 20–26 ounces, and the bladder capacity was 42 ounces. When the bladder was well filled it extended up to the umbilicus, and the examining finger could detect the filled diverticulum spread out in the region of Douglas's pouch, more on the right side than on the left. X-ray pictures with collargol (see Figs. 1 and 2) showed a pouch alongside and cephalad to the bladder of about the same size as that organ and about 5–6 inches in diameter.

As treatment by irrigation did not effect any improvement, and as the right kidney already showed signs of disease due to pressure of the diverticulum on the corresponding ureter, it was decided to operate on the patient and effect, if possible, a radical cure. The fact that the mortality in these cases, if neglected, is very high influenced me in my decision.

Operation.—Transperitoneal excision of the diverticulum.

Suture of the bladder wall and drainage of the retroperitoneal space by marsupialization with a tube.

To assist in the recognition of the right ureter, a catheter was introduced into this, and to allow of filling or emptying the bladder another catheter was placed in this organ. After thorough washing of the bladder, a 5-inch median laparotomy was made with the patient in Trendelenberg. The collapsed diverticulum was difficult to recognize and impossible to define. After filling the bladder with solution its shape and limits could be made out. It was then seen to be in part intraperitoneal, but the major part was extraperitoneal, in close relation with the structures of the pelvis. The whole wound was carefully protected (bladder empty again), and the neck of the sac which admitted three fingers, was cut down upon. The peritoneum and subperitoneal fat was cut through and the muscular wall of the sac reached. The sac was slowly dissected free from its overlying peritoneum, and no serious difficulty encountered until the more dependent parts were reached, where the diverticulum was found to be very adherent. The ureter was easily identified, and found directly in contact with the diverticulum and enlarged, permitting the catheter to move freely from side to side within its lumen. There was very little bleeding in this enucleation, and accidentally the diverticulum was torn into in the inflamed and adherent part. Clamps were placed on the bladder and the liberated part of the diverticulum, and the bridge was cut, and surfaces carbolized. Then the freed part of the diverticulum was cut away, and an attempt made to invaginate the small adherent piece that remained in the depth of the pelvis. This invagination was impossible and the remaining piece of diverticulum was removed by dissection from the deeper pelvic structures, the ureter, vas and vesicle. This was accomplished without any injuries, and then the bladder was closed in layers. The deep layer took in the mucosa and muscularis, and was of catgut, while Pagenstecher was used for the peritoneo-muscular suture. The large hole left in the retroperitoneal space was sutured in great part, and into the opening left a tube was placed. The edges of the peritoneum about this drainage tube were sutured to the parietal peritoneum close to the bladder, thus marsupializing the retroperitoneal space. The wound was closed in layers, and a permanent catheter left in the bladder.

The patient left the table in good condition. Very little blood had been lost, and no fluid had escaped from the bladder or the diverticulum into the operating field.

The patient made an uneventful recovery. The permanent catheter was removed on the tenth day and the patient voided spontaneously 6–10 ounces at a time. Two days later the tube into the retroperitoneal space was removed and this tract healed rapidly. Twenty-six days after operation patient was discharged cured.

The pathological examination shows an inflamed fibromuscular sac wall with a lining of epithelium of the transitional type. In most of the sections the epithelial lining is absent. (Dr. F. S. Mandelbaum.)

The patient continues well, without any symptoms referable to his bladder. His residual urine is 1.5–2 ounces.

Remarks.—The case just described in some detail represents a typical case of diverticulum of the bladder. If one may judge from the structure of its walls, it was a congenital pouch and this is all the more likely as there was no obstruction in the outflow channel to lead to a secondary or acquired diverticulum. As is quite usual in these cases the diverticulum gave no symptoms until it became infected and then despite local treatment the cystitis and diverticulitis continued uninfluenced. If we can place any reliance on the statistical data contained in the literature, this patient would have gone from bad to worse and his kidneys would have become seriously infected (*vide* Englisch, who says that the mortality in such cases is 83 per cent.). After repeated washings of the bladder the diverticulum was approached transperitoneally, so as to give the best view of the condition and to render it easiest to deal with any adhesion that might have developed. The approach was an excellent one, and the operation was much simpler than I had expected. After removing this large sac the equally large retroperitoneal space in which it had rested had to be dealt with, and as this area might very readily have been contaminated, I decided to drain this space by marsupialization, bringing the opening into this space out to the

parietal peritoneum, close above the bladder, so that no band formation could take place between this and the posterior parietes and thus lead to a possible subsequent ileus. The close approximation of the redundant posterior parietal peritoneum to the bladder wall and the very small or shallow shelf thus produced, was, I believe, rapidly obliterated by adhesion to the suture line, which was also effectively protected in this way. The post-operative recovery was very satisfactory and the patient voided within twelve days sixteen ounces at one time. With the removal of this pouch the urine became much clearer and the patient began to pick up, so that within three months he felt perfectly well.

REPORT OF 105 CASES OF STRANGULATED HERNIA.*

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THE 105 cases of strangulated inguinal, femoral, and umbilical hernia herewith reported were operated upon at the Episcopal Hospital within the past six years. Covering as it does quite a large number of cases, and the work of several years, an analysis of these cases, I thought, might prove of interest to the Academy.

It is strange that in the past two decades of progressive surgery, in an era unparalleled by the great strides made in the art of diagnosis, operative technic, and after-treatment, to say nothing of the help obtained by educating the public to surgical conditions, that little has been done, either directly or indirectly, to lower the death rate of this condition.

The onward march of surgery has been from the pelvis upward, until that great divide, the diaphragm, was reached. This obstruction has caused a momentary halt in the advancement of visceral surgery, although a few have crossed over and invaded the thoracic cavity. During this momentary lull in visceral surgery some few have turned back to the old things that were long considered a dead issue. We have but to recall to mind the magnificent work of Lane and Murphy on bones and joints to realize that this momentary pause has been a blessing in disguise. Let us hope that others will turn back to the "dead issue" and that strangulated hernia will be considered.

The mortality of strangulated hernia remains to-day what it was ten or even twenty years ago. It is, unrelieved, an acute progressive abdominal condition, and the mortality will

* Read before the Philadelphia Academy of Surgery, May 5, 1913.

Statistics.

Inguinal Hernia

Right			Left		
Male	34	Rec.	Male	6	Rec.
Female	3		Female	1	
Male	10	Died	Male	2	Died
Female	3		Female	1	

Recovered 44, died 16, not operated (died) 3, total.....63.

Femoral Hernia

Right			Left		
Male	0	Rec.	Male	1	Rec.
Female	12		Female	5	
Male	1	Died	Male	0	Died
Female	4		Female	2	

Recovered 18, died 7, not operated (died) 2, total.....27.

Umbilical Hernia

Right			Left		
Male	3	Rec.	Male	1	Died
Female	8		Female	8	

Recovered 11, died 9, not operated (died) 1, total.....21.

Ages of Patients.

Age.	Inguinal.		Femoral.		Umbilical.		Mortality.
	Rec.	Died.	Rec.	Died.	Rec.	Died.	
1–10	5	1	..	..	..	..	16 per cent.
10–20	4	1	1	..	..	..	16 per cent.
20–30	8	0	4	..	..	..	0 per cent.
30–40	8	3	3	2	3	1	30 per cent.
40–50	7	3	4	2	3	3	36 per cent.
50–60	3	4	3	1	4	3	44 per cent.
60–70	8	2	1	1	1	2	33 per cent.
70–80	1	2	2	1	..	..	50 per cent.
Total..	44	16	18	7	11	9	

Number of Hours Strangulated.

Hours.	Inguinal.		Femoral.		Umbilical.		Mortality.
	Rec.	Died.	Rec.	Died.	Rec.	Died.	
1–12	21	1	7	0	4	1	5 per cent.
12–24	17	7	8	2	5	3	28 per cent.
24–48	3	2	2	2	2	1	41 per cent.
48–	3	6	1	3	0	4	76 per cent.
Total..	44	16	18	7	11	9	

Mortality

Inguinal	Per cent.	Femoral	Per cent.	Umbilical	Per cent.
Right inguinal, male,	22	Right femoral, male	100		
Left inguinal, male,	24	Left femoral, male,	0		
Right inguinal, female,	50	Right femoral, female,	25		
Left inguinal, female,	50	Left femoral, female,	28		

Inguinal mortality:		Femoral mortality:		Umbilical mortality:	
Male	23	Male	50	Male	25
Female	50	Female	26	Female	50
Total inguinal mortality:		Total femoral mortality:		Total umbilical mortality:	
Male and female	26	Male and female	28	Male and female	45

Total Mortality

Male	24 per cent.
Female	38 per cent.
Male and female	30 per cent.

continue to remain unchanged until the profession and public, as in appendicitis, and as we are trying to do in cancer, become better educated to the fact that an early operation and the avoidance of taxis in hernias are the two most important factors in lessening the mortality.

Unfortunately, we cannot in strangulated hernia as in appendicitis with peritonitis, "dry dock our patient for repairs," and hope for an abeyance of the symptoms, and after localization of the inflammatory process, a successful operation and ultimate recovery of the patient.

Of the 105 cases of strangulated hernia, 58 were males and 47 were females. Sixty were inguinal, 25 femoral, and 20 umbilical. During this period of six years 848 cases of hernia of the above types were operated upon at the Episcopal Hospital. Three of this number were strangulated. Six cases of strangulated hernia were admitted to the hospital in a moribund condition and no operation was attempted.

The great majority of these cases of strangulated hernia gave the usual history of having had the hernia for years and of wearing an ill-fitting truss. The symptoms varied. Among the most constant were sharp pains at the hernial orifice, colicky pains, nausea and vomiting. So constant were the last three symptoms mentioned, paroxysmal pain, nausea and vomiting, that when not reported on the histories, I believed

their absence due to an error on the part of the history taker in failing to record them. In almost every instance taxis had been tried by the patient and also by the attending physician.

The ages of the patients ranged from six weeks, the youngest, to eighty years, the oldest; and the duration of the hernia, non-strangulated, from two weeks to sixty years.

The condition of the patients on admission to the hospital varied, depending almost entirely upon the degree and length of time the hernia had been strangulated. The cases admitted in shock, with a subnormal temperature, fast pulse, etc., showed the highest mortality.

The diagnosis is usually easy. Only in one or two instances were the patients referred to us with an incorrect diagnosis, and these were either in small femoral hernias, or in inguinal hernias in which the attending physician recognizing a surgical condition had failed to make a thorough examination. In two instances the condition was mistaken for an appendicitis with diffuse peritonitis.

In any patient giving a history of a hernia coming down and not being able to reduce it, or an irreducible hernia becoming larger and more tense, and if either condition is followed by pain at the hernial orifice, colicky pain, nausea, and vomiting, a strangulated hernia should immediately be thought of. Speculations as to whether the hernia is irreducible, obstructed, inflamed or strangulated, depending on the passage of flatus, percussion sound, or the presence or absence of peristalsis in the hernial sac are misleading and the delay in waiting for such symptoms jeopardizes the life of the patient. The redness of the skin and the exquisite tenderness of the hernia, I believe, is often due to local applications, and too prolonged or vigorous taxis.

One often wonders, after operating on a case and seeing the hernial sac full of blood, and the bruised and injured condition of the intestine, if it would not have been better, certainly since the perfection of hernial surgery, if our medical schools would cease to teach the practice of taxis except in a few limited instances. Taxis, like all good things, is often

overdone. It no doubt saves many from being operated upon, and in instances when surgical aid is unobtainable, is frequently a life-saving device. It, nevertheless, causes the death of many. Certainly, in a large percentage of the cases in this series, can the mortality be attributed to the delay caused by taxis.

Simple taxis, or taxis aided by an anæsthetic, morphine injection, local application, hot bath, elevation of the foot of the bed, etc., often prolongs for hours or days the question of operative interference. So important was the question of taxis, and so dangerous its use, that the old surgeons tried to place a limit of time, varying from a few minutes to two hours, during which it was safe to persist in its use. Coley does not think it wise to continue taxis for more than five minutes. The same author believes that taxis should never be attempted in those cases " in which the symptoms of strangulation have been exceedingly severe from the start," in those " in which strangulation has occurred in previously irreducible hernias," and in cases " in which 24 hours have elapsed after strangulation."

The preparation of the patient for operation should be the same as for the usual emergency case. If the patient is vomiting, and especially if the vomitus is fecal in character, the stomach should be washed out. It is believed that the washing out of the stomach of these cases lessens the chance of an aspiration pneumonia, especially if ether be the anæsthetic.

The anæsthetic used depends largely upon the operator, the condition of the patient, and the technic to be employed. In the above cases, ether, chloroform, local and spinal anæsthesia were used.

Ether, I believe, in the majority of instances, is the anæsthetic of choice, and if used, should be preceded, in the cases with fecal vomiting, by washing out the stomach.

Chloroform has a very limited use, but occasionally can be used advantageously in cases with kidney or lung complications.

Local anæsthesia is of advantage in cases complicated by

cardiorenal and lung conditions. The increased length of time required to perform the operation under this anæsthesia, and the mental shock often accompanying it, are its chief disadvantages.

Spinal anæsthesia has a very limited use. I believe it to be a dangerous anæsthetic, even in the hands of the most expert, and certainly should be used cautiously in the aged and in cases of long duration.

Unless absolutely contra-indicated ether is certainly the anæsthetic of choice, and from the deaths recorded in this series, is not complicated by pneumonia or uræmia any more frequently than any of the other anæsthetics mentioned.

The operation performed must relieve the constriction, and if the gut is not gangrenous, return it to the abdominal cavity. If the gut is not viable, and that often is a very hard question to decide, one of the following procedures must be adopted.

If it is a border line condition and you are unable to decide whether the gut is gangrenous or not, it can be left in the wound for 12 to 24 hours until all doubt has passed.

If the gut shows a small gangrenous area we have been quite successful by invaginating this spot. If a large gangrenous area is encountered this portion of the gut must be resected and either a lateral or end-to-end anastomosis performed, the latter preferred, or an artificial anus can be established. Our statistics favor the resection method. In either instance the cases are most unfavorable and the mortality is very high.

One of the most remarkable recoveries in this series was in a woman, 50 years of age, with a hernia of the femoral variety involving the small intestine, which had been strangulated for four days. An artificial anus was established, which later healed spontaneously.

In strangulated hernias of the so-called Richter type, or partial enterocele, either femoral or inguinal, the mortality is high. This is probably due to the fact that these hernias are small, are often overlooked, and consequently come to the

surgeon late. In this type, on three occasions, the hernia reduced itself while the patient was being anæsthetized. In the first case, a herniorrhaphy was performed without exploring the gut; the patient died in two days of a diffuse peritonitis and the autopsy showed a perforated gangrenous area the size of a penny. In the other two cases, at the time of operation, the gut was caught and pulled down into the wound, thus ascertaining the true condition of affairs.

The hernias that reduce themselves while the patient is taking an anæsthetic, especially if the strangulation is of several hours' duration, and the gastro-intestinal symptoms have been marked, should be operated upon, as the true condition of the gut should be ascertained. One of the umbilical hernias in this series reduced itself while the patient was being anæsthetized, no operation was performed. The patient died a day or so later and the autopsy showed a volvulus of the ascending colon.

In the majority of instances of strangulated hernia there is little doubt as to the viability or not of the intestine. In some cases, however, the decision would tax the judgment of the most expert. The best test for the viability of the intestine is the application of compresses wrung out in hot saline solution, although help can be obtained by noting the loss or not of the glossy appearance, whether the gut is dull and granular, whether its color is red, purple, black, grayish or mottled, and also if the gut is firm and elastic or soft, flabby and collapsible.

Kocher lays great stress on the pulsation of the vessels of the mesentery and bowel.

If resection is to be done the excision should go wide of the gangrenous area, especially is it important to do so to the proximal side and get beyond the distended and water-logged portion into healthy bowel.

In all cases operated upon the ideal operation is a herniotomy and herniorrhaphy. Unfortunately, this is not possible in some, as the physical condition of the patient may only warrant the relief of the constriction. In large scrotal and

umbilical hernias, on account of the many and dense adhesions, it is often best to simply relieve the constriction. Especially is this true if the patient's condition does not warrant a prolonged operation.

In this series 32 cases died. The cause of death was as follows: Peritonitis, 11; uræmia, 3; pneumonia, 4; shock, 5; myocarditis, 2; delirium tremens, 2; apoplexy, 2; acute dilatation of heart, 1; volvulus, 1; sarcomatosis, 1. The five cases that died of shock were desperate ones and really should be classed under deaths due to peritonitis.

The prognosis depends almost entirely upon the degree and length of time the hernia has been strangulated and the resisting power of the patient.

The type of hernia, the sex and the age seems to have some bearing on the mortality. The death rate is lowest in children and highest in the aged. The mortality is higher in femoral than in inguinal and is highest in the umbilical.

The reduction of the mortality of strangulated hernia, as stated earlier in this paper, depends upon the education of the public and shall I say, profession, to the importance of early operation and the avoidance of prolonged and vigorous taxis.

The prevention of strangulated hernia is likewise an educational one. By educating the public to the danger of a simple hernia becoming strangulated, and the importance of having the hernia operated upon, or if operative treatment be refused, the wearing, under the supervision of a physician, a properly fitting truss will reduce the number of this almost inexcusable condition.

In closing, I wish to make a plea that all simple hernias in children, and especially those of the scrotal type, be operated upon. I believe it is wrong to order a truss for these cases, when we know the percentage of cures is very small. If a radical cure be performed in these cases, we have taken a great step toward the prevention of strangulated hernia.

IMMEDIATE AND LATE RESULTS OF THE WHITEHEAD OPERATION FOR HEMORRHOIDS.

A REVIEW OF 470 CASES.

BY HARVEY B. STONE, M.D.,

OF BALTIMORE, MD.

ALMOST since the description by Whitehead of the operation for hemorrhoids which bears his name, there has been animated controversy as to the merits and demerits of the procedure. Among the acquaintances of the writer there are many men, particularly rectal specialists, who highly disapprove of the Whitehead operation. On the other hand, many general surgeons of the highest attainments, whose opinion certainly should carry much weight, employ practically no other method in the treatment of piles, maintaining that if the operation be properly performed it is not likely to be followed by unfortunate consequences. The material accumulated at the Johns Hopkins Hospital afforded excellent opportunity to study the results of the Whitehead operation, as this has been the method of choice on the surgical service, since the hospital was opened, twenty-four years ago. With the kind permission of Dr. Halsted, the writer has undertaken to follow the subsequent history of the Johns Hopkins Hospital cases from 1889, when the work began, until 1910, when this review was undertaken. In addition to these cases, those operated on by Dr. J. M. T. Finney at the Union Protestant Infirmary have been investigated and included in this report. I wish to express to Dr. Halsted and to Dr. Finney my great appreciation of this privilege.

The unique feature of this article and the one which, perhaps, best justifies its publication, is the fact that the 470 Whitehead operations which are herein reported were performed by 45 surgeons, young internes for the most part, and some of them in the first year of their hospital service. Hence

it may be assumed that the results obtained in this series of cases are not much better than might be expected at the hand of the average surgeon.

In surveying the literature I have given no consideration to the many papers describing minor modifications in the technic of applying the Whitehead principle nor to the numerous articles reporting one or two unfortunate results following attempts at the Whitehead operation. Whitehead[1] himself, in 1887, published a series of 300 cases which he had operated on by the circular method. Omitting particulars, he makes the simple statement that there were no deaths and no post-operative complications, such as hemorrhage, ulceration, abscess, stricture or incontinence. This paper was in the nature of a reply to critics and is less convincing than it might have been had the cases been reported in greater detail.

Yukelson[2] published a paper in Russian, the title of which translated is "Three Hundred and Thirteen Operations for Hemorrhoids by the Whitehead-Veresco Method." Unfortunately this article has not been accessible, and cannot be reviewed.

W. Graeme Anderson[3] in 1909, published a study of the after results of 300 hemorrhoid operations. Of these 150 were operated by the ligature, 100 by the Whitehead method, and 50 by the clamp and cautery.

By Anderson the Whitehead method was considered the most painful and the cautery the least painful; the catheter was necessary in 10 per cent. of the ligature cases, in 6 per cent. of the Whitehead cases, and in none of the clamp and cautery cases; the return of sphincter control was earliest after the cautery and latest after the Whitehead operation. There seemed to be a greater tendency to stricture after Whitehead operations than after the others, especially when the area healed by granulation was large. The statement is made that no Whitehead case healed by first intention; that skin tags were least often found after the Whitehead and most frequently after the use of the ligature. There were no recurrences within six weeks in any of the cases. Post-opera-

tive hemorrhage occurred after ligation in four cases, after the Whitehead operation in two cases, and in no case after the cautery. Very few of these cases were observed for more than a year.

In 1910, Takaki[4] reported briefly 176 cases. There were three strictures, two ulcers, and one death (from pulmonary embolus) in this series, but no note is made as to how many of the cases were observed after operation, nor for what period of time. One instance of paralysis of the sphincter is also noted, but with the statement that this condition existed before operation and was not a consequence of it.

O'Conor,[5] in the same year, describing minor variations in the technic as practised in his clinic, incidentally records 490 cases successfully operated on by the Whitehead method, but with no specific details as to post-operative study of the patients.

While the present paper was being written, Hadda[6] published a paper dealing with the same subject his material embracing 223 cases, of which 127 were seen or heard from afterward, some of them after the lapse of 7 years. Among these patients there were three post-operative hemorrhages and one death, the latter attributed to scopolamine poisoning from idiosyncrasy. 155 cases required catheterization, and in 104 of these cases it was necessary beyond the first day. Of the 27 cases examined, three had small skin tags, one a small prolapse of mucosa, and one a small ulcer of the mucosa. Among the cases replying by letter, one complained of "weakness" and pain in the rectum, one of the persistence of a sigmoiditis antedating operation, and a third of slight stenosis. The others reported themselves as satisfied with the results obtained.

Besides these articles there are several dealing with a much smaller group of cases. Martin,[7] Veron,[8] Labaume,[9] and McGlannan[10] report series of from eleven to thirty-nine cases, all with good immediate results. But very few of the patients were observed for more than a few months.

I was rather surprised to find that in my collection there

were no deaths, nor are there any notes as to the occurrence of anæsthesia disturbances, such as pneumonia and bronchitis. The absence of pulmonary complications may be due, at least in part, to the position of the patient on the operating table (head low and high buttocks), which prevented the gravitation of mucus, etc., into the respiratory tract. In many of the cases there were pre-operative complications. Thus in eight there was fistula, three were neurasthenics, and three suffered with fissure, two had rectal ulcer, two hernia and two polypi; others suffered from amœbic dysentery, chronic prostatitis, enlarged prostate, pilonidal sinus, lues, severe secondary anæmia and urethritis.

Among the post-operative complications are the following: in one case a hæmatoma which became infected; in four cases post-operative hemorrhage; in six cases there was infection of the suture line which caused a local abscess; post-operative ischiorectal abscess was observed once; in two cases there was post-operative fecal impaction, and in one of these chloroform was required for its relief. In most cases a lead and opium pill containing 1 grain of opium was given three times a day, for the first three or four days. In addition to this most cases required one or two doses of morphia (gr. one-eighth) hypodermically. In a few cases much larger amounts were required—as much as 3 grains of morphia in one case which was complicated by an extensive infection. In not all instances was a note made as to the necessity for catheterization; but memoranda as follows were obtained: catheter not used, 36 cases; used once, 43 cases; used twice, 15 cases; used three times, 20 cases; used more than three times, 42 cases. In one case the patient had to be catheterized for twelve days after operation. As to the condition of the wound at the time of the patient's discharge from the hospital, it was noted that there was a granulating surface of greater or less extent in 116 cases. The average time of detention in the hospital after operation in the first years of this series was about fourteen days; this has been reduced to about ten days in the later years.

To obtain the subsequent history of the cases treated by

the Whitehead operation has been the chief purpose of this investigation. To secure data on this point a questionnaire was sent to each patient with specific interrogations, and a request for an examination if possible. As a result we have seen or heard from 185 cases. Of this number 31 have been operated on less than five years, 59 from five to ten years, 58 from ten to fifteen years and 37 from fifteen to twenty-two years. From the answers received and from examination of the cases, I conclude that the results were perfect in every respect in 134 cases, a percentage of 72.4. The most frequent complaint was disturbance of the sphincter action. This complaint was variously phrased; "weakness of control of the bowel" or "imperfect control" were common expressions, and in many cases the statement was made by the patient that he experienced inconvenience in this respect only when from medication or indiscretion in diet there resulted an attack of diarrhœa. There were 37 cases in which the muscular control was more or less impaired but in only one of these was there actual paralysis of the sphincter. It should be noted that this patient developed hemiplegia five years after his operation, hence it is not clear that the Whitehead operation was alone responsible for the paralysis of the sphincter. Of these 37 patients there were eight who complained of itching or moisture following the operation, but in most of them this was a temporary condition.

It will be seen that, except in the case of the hemiplegic, there was no instance of serious incontinence in the whole series. In this connection it should be remembered that where large prolapsing hemorrhoids have existed for years the sphincter is no doubt flaccid and weakened before operation.

A number of patients wrote that they had been bothered for five or six months by sensory disturbances. In 16 the itching and moisture is still complained of by the patient. In many instances the annoyance was said to be "slight."

In 5 cases there is a certain degree of stricture. Two of these were examined by the writer personally. One of them did not know that he had a stricture; in him there was found

a narrow wire-like ring of fibrous tissue of wide calibre which easily admitted the index finger and caused no symptoms. In 14 cases a recurrence in some measure had taken place. One of these patients wrote that for 19 years he had had a perfect result, and then developed a thrombotic external pile. Another states that he had two small skin tags remaining from the operation. A third that he has a small external pile. Another merely says that there is still "some bleeding." Four others have what they describe as a "little return" of the piles. One patient, in response to letters, returned to the hospital, was re-admitted, and operated upon for an isolated hemorrhoidal polyp, which had developed since his original operation. In five cases there was more or less extensive recurrence of the hemorrhoids and of these, three were operated upon the second time. Upon one of the three a third operation was made, each of the operations being performed by a different surgeon and by a different method. This patient states that he still suffers from hemorrhoids.

Conclusion.—The Whitehead operation should not be considered a formidable procedure nor one which results "commonly in incontinence and stricture," as is frequently stated. It does not absolutely and forever preclude the return of varicosities, as some of its advocates claim that it does. A definite indication for its employment is the existence of a rosette or complete circle of varicosities. The simple cases presenting one or several isolated hemorrhoids may not require the Whitehead operation for their relief, but the minor procedures are not so thorough and seem less likely to result in a radical cure.

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A METHOD FOR THE MECHANICAL FIXATION OF TRANSVERSE FRACTURES.

BY H. S. SOUTTAR, F.R.C.S.,

OF LONDON.

Assistant Surgeon, West London Hospital; Surgical Registrar, London Hospital.

THIS method has been devised with a view to obtaining a more accurate and substantial fixation in transverse fractures of the femur and humerus especially, than has hitherto been possible. The plate used is of thin sheet steel and instead of lying upon the surface of the bone is for the most part buried in its substance. For this purpose a slot is cut longitudinally in the two fragments of the bone with a small circular saw.

The plate is 1 cm. or more wide and from 5 to 10 cm. in length. The whole of this portion is intended to be buried in the bone. A narrow flange projects from one edge and is to lie on the surface of the bone. This flange may be provided with holes for screws. In other cases it may be preferred to fix it with wires encircling the bone.

The saw is 4 cm. in diameter and is provided with a substantial handle and a guard. It can be boiled entire, it can be readily taken apart, and it can be adapted to any form of motor. The teeth are so constructed that they do not tend to catch in the bone though they cut with great freedom. The appliance is extremely easy and safe to use.

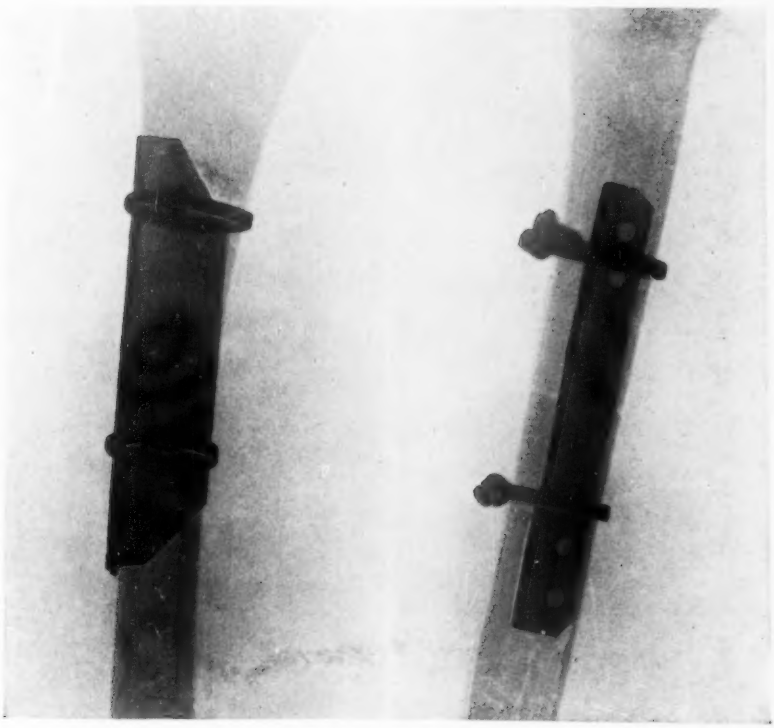
In most cases screws will be preferred and a special form of screw is provided. They are of steel with a fine thread, as they are intended to engage only in the compact bone. The point is slightly tapered and this portion of the screw is flattened on one side. A sharp edge is thus left by means of which the thread actually cuts its way into the dense bone. The screw may thus be driven into the bone with great freedom and scarcely any resistance is encountered till it is actually home. A solid hold is thus obtained which is impossible with other types.

An incision is carried down to the bone and the two fragments are manipulated into line. In a case of transverse fracture it will usually be possible to make the jagged ends engage. The fragments are held firmly in line by an assistant and with the circular saw a slot of sufficient length is cut in the long axis of the bone, care being taken that it is accurately at right angles to the surface. With the special saw it will be found that this is quite easy and that even in deep wounds the flaps do not seriously interfere, the guards on the saw pushing them out of the way. Immediately the slot has been cut the plate is inserted. Screw holes are drilled, the tapered ends of the screws are inserted and the screws are driven home. The taper enables the screw to support itself while the driver is applied. An occasional backward turn of the driver will clear the thread of the screw and enable it to cut more cleanly. If it is preferred, wires encircling the bone may be used instead of screws.

The chief advantage of this method is the great solidity of the fixation. In the case of a fracture of the femur it is quite practicable to get the patient out of bed on the next day should his condition demand it, and passive movements of the joints may in all cases be begun at once. Splints are quite unnecessary and in fact harmful as they tend to interfere with the efficient circulation which is so essential to repair. The girder form of the plate allows it to be made of thin material without impairing its strength. Only a small portion of the plate appears on the surface of the bone and the heads of the screws are rounded so as to fit snugly up against it. There is thus very little projection on the surface and no interference with muscular action. The existence of the plate inside the bone seems to give rise to no trouble. It is probable that in most cases the whole plate is soon buried in callus.

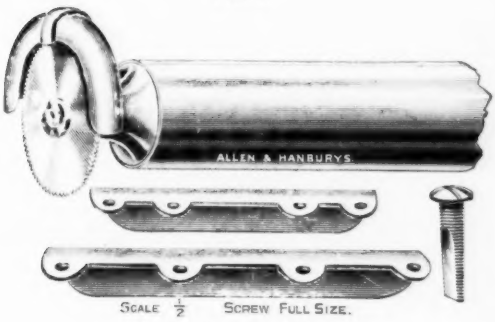
Though the method is not adapted to many forms of fracture it appears to meet admirably the requirements of the two for which it was specially designed, namely, transverse fractures of the femur and humerus about the middle of the

FIG. 1.



Plates applied to femur.

FIG. 2.



Souttar's saw and plates.

shaft. The value of a method which ensures immediate and absolute fixation and which dispenses entirely with splints in these important and somewhat difficult cases will probably be appreciated.

The accompanying plates (Figs. 1 and 2) show the saw, screws and plate, and the method as applied to the femur of a boy of twelve years whose fracture had failed to unite by the ordinary methods. The operation in this case was carried out by Mr. Milne, of the London Hospital. The boy walked at the end of three weeks and when seen two months after the operation presented a result functionally perfect.

The plates, screws and saw have been made to my designs by Messrs. Allen & Hanburys from whom they may be obtained.

A FURTHER NOTE ON REDUCTION OF FRAGMENTS IN FRACTURES OF THE LONG BONES AT OPEN OPERATION.

BY JOHN C. A. GERSTER, M.D.,

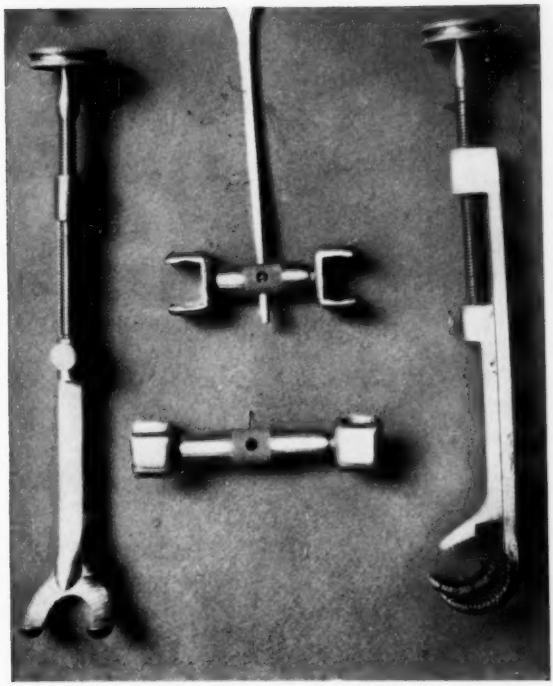
OF NEW YORK.

Adjunct Surgeon to Mount Sinai Hospital; Assistant Surgeon to City and to Knickerbocker Hospitals.

SOME months ago I described a method for distracting the overlapping fragments of a fractured long bone by means of a turnbuckle placed between two Lowman clamps,[1] one on each fragment (Fig. 1). As the turnbuckle forces the clamps apart, the resistance of the soft parts increases. This resistance is chiefly noticeable on the side of the bone opposite to where the turnbuckle is applied. The tendency is for the fragments to kink (Fig. 1), and for the shafts of the Lowman clamps to diverge instead of remaining parallel. If the divergence is at all marked, the turnbuckle's jaws slip up the shafts and slide out of place. To prevent this occurrence it is necessary *a,* to place the turnbuckle as close down to the bone as possible; *b,* to keep the two clamps parallel to one another by means of an assistant's hand which grasps both milled heads of the Lowman clamps, one with the finger tips, the other with the hollow of the palm. At that time, I thought of using a second turnbuckle armed with hooks to accomplish this, but I chose manual rather than mechanical control because of the danger of using too great force with the latter method. However, the experience of W. H. Bishop, of New York, whose material has been much greater than my own, has shown that it was awkward and rather unsatisfactory for an assistant to control the clamps. During a difficult reduction of a fractured tibia he accordingly slipped the loop handle of one of the Lane bone retractors over the free ends of both

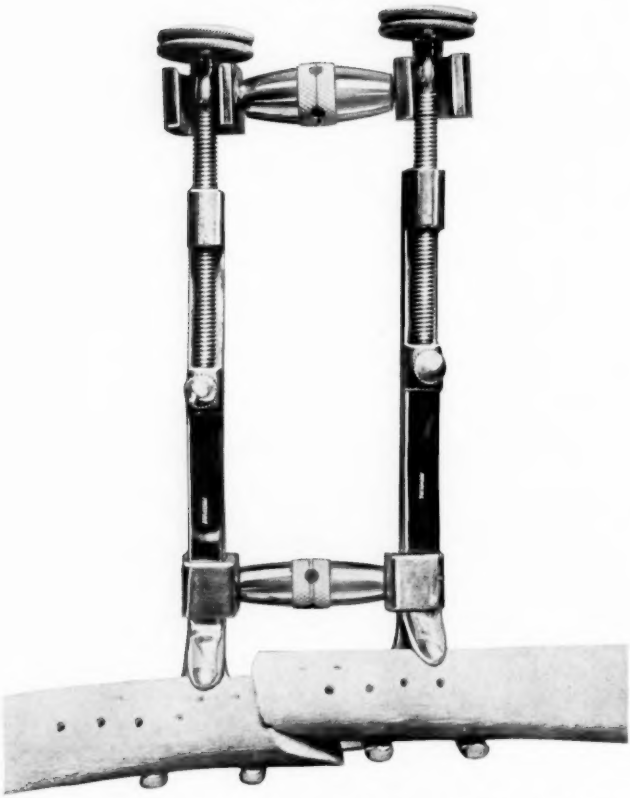
[1] "Reduction of the Fragments in Fractures of the Long Bones," ANNALS OF SURGERY, November, 1912, p. 769.

FIG. 5.



Anterior and lateral view of modified Lowman clamps. Smaller turnbuckle with key in place. Range of smaller turnbuckle is from 1⅞ to 2½ inches; range of larger turnbuckle is from 2⅜ to 3½ inches.

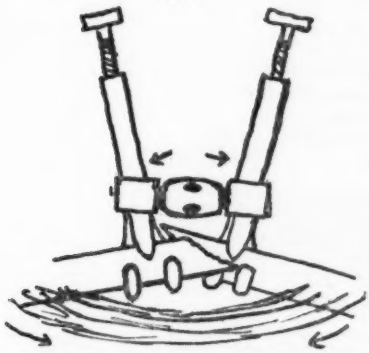
FIG. 6.



Photograph of clamps and turnbuckles applied to an adult femur (as in Fig. 3*a*).

Lowman clamps and blocked up the free space left at one end until the clamps were parallel. As the turnbuckle forced the clamps apart, one block after the other was removed. Reduc-

FIG. 1.

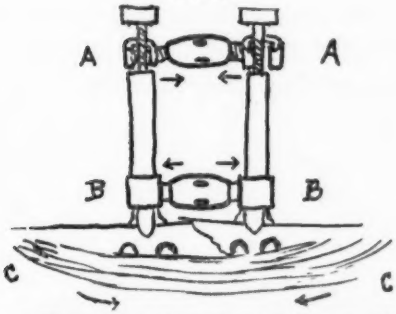


Showing tendency for distal ends of Lowman clamps to diverge because of resistance by soft parts.

FIG. 2.

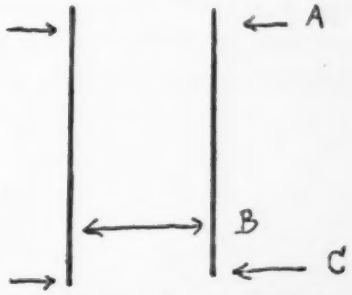
Turnbuckle armed with hooks.

FIG. 3a.



Divergence controlled by hooked turnbuckle at *AA*. Arrows indicate lines of force. Usually it is more convenient to apply turnbuckle at *BB*, maximally contracted, and to apply hooked turnbuckle at *A A*, expanded sufficiently to engage diverging shafts. Then this same turnbuckle at *A A* is contracted until clamps are parallel or nearly so, after this expansion of turnbuckle at *B B* can begin.

FIG. 3b.



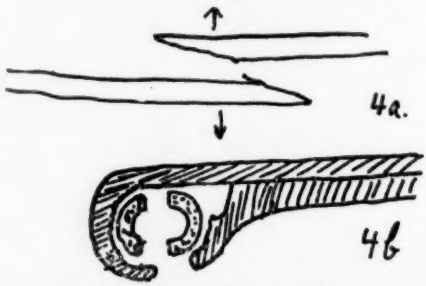
The Lowman clamps constitute levers; the turnbuckle at *B* is the fulcrum, the resisting soft parts at *C* and the turnbuckle at *A* balance each other.

tion was easy, and control was much more certain than by the assistant's hand. This crude make-shift was so satisfactory, that a turnbuckle was made, armed with hooks (Fig. 2) to keep the clamps parallel. As the turnbuckle close to the bone forces the clamps apart, the upper turnbuckle is released

just enough to maintain a proper parallel position of the Lowman clamps (Fig. 3*a*).

The six appended figures with their legends explain the mechanical conditions encountered and their method of con-

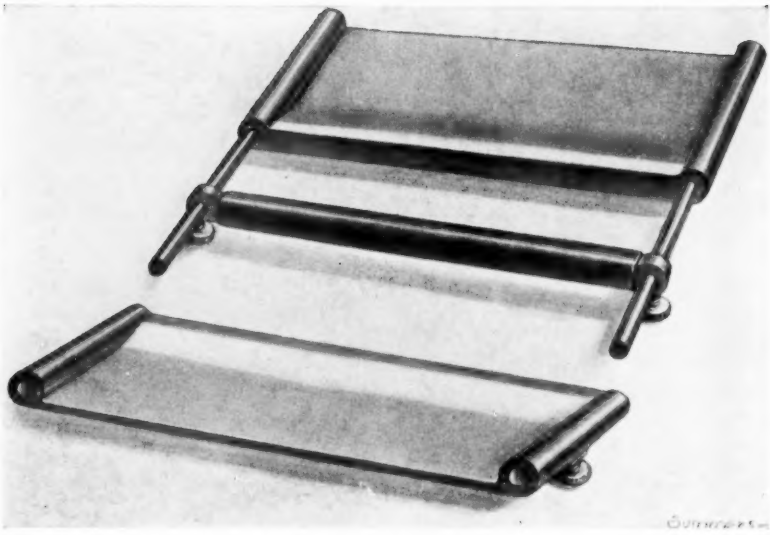
FIG. 4.



4*a*, during distraction frequently there is a tendency to lateral displacement. 4*b*, a third Lowman clamp, which embraces both fragments but is not tight enough to prevent distraction, readily controls this.

trol. I still recognize the ease with which too great force can be applied by this method. Distention should be gradual, not sudden; after a certain amount of resistance is met with, it is well to pause a minute or two and then proceed again.

FIG. 1.



Gastro-enterostomy clamp.

A DEVELOPMENT OF THE AUTHOR'S GASTRO-ENTEROSTOMY CLAMP.

BY WILLARD BARTLETT, A.M., M.D.,

OF ST. LOUIS, MO.

IN the ANNALS OF SURGERY for November, 1912, appeared Dr. Buchanan's article entitled "A Modification of Bartlett's Gastro-enterostomy Clamp." His most excellent suggestion referred to an instrument which I presented in the ANNALS of August, 1911.

The contrivance referred to produces uniform pressure at every point, the amount being directly determined by the fingers applying the instrument.

The accompanying illustration shows how the original idea has been developed and the contrivance improved. The two outside blades are now made so wide that the viscera and packs are held out of the operator's way, while at the same time the likelihood of soiling is greatly lessened. This later instrument is much easier to apply than was its predecessor. Now one has merely to compress the stomach between the fixed outside blade and the middle blade, which can be locked in position by the thumb screws underneath. In like manner the jejunum is fixed separately between the middle blade and the floating broad blade. All is now ready for the suture.

To remove the instrument, merely unfasten the four thumb screws underneath and withdraw the fixed broad blade. This allows the other two blades to fall apart and be taken out separately.

THE CHEVALIER JACKSON METHOD OF FINGER ELEVATION OF THE HYOID BONE IN GENERAL ANÆSTHESIA.

BY ELLEN J. PATTERSON, M.D.,

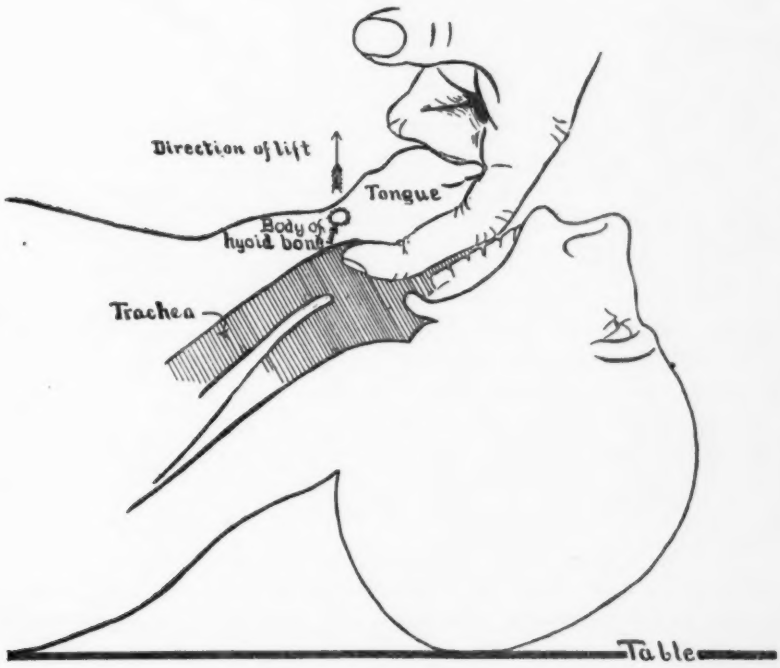
OF PITTSBURG, PA.

Assistant Professor of Laryngology, University of Pittsburg; Laryngologist, Presbyterian Hospital; Rhinologist, Eye and Ear Hospital Dispensary.

WHEN the patient begins to lose consciousness in general anæsthesia, the tongue is prone to drop backward and obstruct the breathing. A very small amount of secretion then gives the impression that the patient is " full of ether mucus." Various tongue forceps, of more or less cruel design, and even a loop of suture material through the tongue, are used to draw the tongue forward. Bimanual upward traction at the mandibular angle is a well known and fairly satisfactory method of elevating the base of the tongue. By far the best method, however, and one which seems generally unknown, is to elevate the hyoid bone with the index finger introduced through the mouth and passed deeply posterior to the tongue, the motion being made as if to raise the entire head and neck with the *tip* of the finger, precisely as the hyoid bone and epiglottis are lifted with the Chevalier Jackson laryngeal speculum in direct laryngoscopy. In fact it was in Dr. Chevalier Jackson's clinic where it has been in use for years, that I was taught this finger method of elevating the hyoid bone to free the air passages. The method frees the breathing in a way that no amount of traction on the end of the tongue can accomplish. A patient who has been taking the ether badly, with cyanotic color, intense venous engorgement, in short the kind of patient who is generally known among anæsthetists as " a bad actor," will, immediately, upon using the hyoid bone elevation, take one great deep inspiration and thereafter will breathe so quietly that, unless the thoracic respiratory movements are noted, one is apt to think that

breathing has ceased altogether. The color will clear up and the breathing will thereafter be free if the patient's head be maintained in the forced extension, direct laryngoscopy position (Fig. 1), with the head flat on the table. In this position, the neck is thrown upward and the hyoid bone is maintained in an elevated position once it has been elevated with the

FIG. 1.



Schema illustrating the Chevalier Jackson method of hyoid bone elevation to free the air passages during general anæsthesia.

finger, by forcing the patient's forehead downward toward his feet. If desired, of course, the finger could be kept in place while the administration of the anæsthetic is continued by wrapping with towels, but this is unnecessary, if the position is correct. If the patient is only very slightly anæsthetized, retching may be caused by the presence of the finger, but the ether can be pushed as soon as a free air passage is restored. Some sort of bite block or gag must be used to prevent the finger being bitten, but wide gagging defeats the hyoid elevation.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated meeting, held at the New York Academy of Medicine, April 23, 1913.

The President, Dr. Charles L. Gibson, in the Chair.

CARDIOLYSIS.

Dr. Charles N. Dowd presented a boy, nine years old, on whom he had done the operation of cardiolysis as an endeavor to mitigate his sufferings from an adherent pericardium. The boy had suffered from cardiac disability for five years, following rheumatism, of which he gave a history of repeated attacks, at one time being confined to bed for three months.

At the time of his admission to St. Mary's Hospital for Children, on October 25, 1912, his dyspnœa was excessive. He was unable to lie down nor could he take any exercise. He complained of precordial pain, and coughed after exertion or on reclining. Both physical examination and radiographic findings indicated an enormous cardiac enlargement. The right border of the heart was to the right of the sternum, and its left border was at the anterior axillary line. The apex beat was in the fifth intercostal space, three and a half inches to the left of the median line. There was a loud, rough systolic murmur at the apex, which was transmitted to the left. The pulmonic second sound was accentuated. The extremities were œdematous.

After careful hospital treatment for two months the boy showed slight improvement, but upon returning home his symptoms quickly recurred, and he was readmitted to the hospital.

Operation, January 31, 1913: About two and a half inches were taken from the anterior ends of the left third, fourth, fifth and sixth ribs and their cartilages, leaving a little of the posterior periosteum, as recommended by Fritz Koenig, but clearing it very

thoroughly, as suggested by McEwen. After this hard portion of the chest wall was removed, the remaining portion moved very freely with the cardiac pulsations.

The boy's convalescence was interrupted by an attack of bronchopneumonia, but at the present time, nearly three months after the operation, he is slightly better than he was before he had been operated on. The mechanical procedure in this case, Dr. Dowd said, was easy. The result, up to this time, was neither very encouraging nor very discouraging, and it indicated that further trials might well be made in properly selected cases.

FOUR GASTRIC AND DUODENAL CASES BEARING ON THE QUESTION OF AN OPEN PYLORUS AFTER GASTRO-ENTEROSTOMY.

DR. EUGENE H. POOL presented the following patients: CASE I. *Persistent Vicious Circle.*—The first case of the series was shown to illustrate the possible ill-effects resulting from the coexistence of a wide-open pylorus and a gastrojejunostomy. Closure of the pylorus in this case effected a cure, showing that the symptoms—persistent vomiting and emaciation—were due in this case to the open pylorus.

The patient was a Sister of Charity, thirty-two years old, who was operated on in another city six months before she came to the French Hospital. The operation had been done for the relief of gastric symptoms of about six months' duration, consisting of severe attacks of pain usually coming on from fifteen minutes to half an hour after meals, and vomiting; the vomitus often containing blood. The particulars of this operation could not be learned, but the patient stated she was told that an ulcer was found. Directly after the operation she said she began to vomit, at first mucus and gastric juice; later bile-stained fluid. Gradually this symptom became more aggravated until she vomited almost continuously, often several basinsful daily. She seldom could retain food, sometimes being able to keep down a few ounces of peptonized milk, but nothing solid. This continued for six months, and she became much weakened and emaciated.

Operation revealed a large gastro-enterostomy opening and a normal pyloric opening. There were no apparent kinks or adhesions, nor any lesion in the stomach or duodenum. It was decided that closure of the pylorus was likely to relieve the symptoms, and

that at the same time it was the safest procedure. Because of the uncertainty of its result, however, and the poor condition of the patient, the simplest method was employed. A heavy catgut suture was passed around the pylorus and tied so as to close its lumen, but not crush the tissues. A number of linen Lembert sutures were inserted, approximately the tissues across this groove; these were placed on the anterior surface and as far posteriorly as possible. Vomiting occurred for four days after this operation and then ceased. Since then the patient had remained perfectly well; she had gained considerable weight and strength, and could eat any kind of food.

CASE II. *Gastro-enterostomy with Occlusion of Pylorus by Ligature-suture Method for Duodenal Ulcer.*—Dr. Pool said that even before the above described experience he had felt that an effort should be made to avoid producing a gastro-enterostomy if the pylorus was left open or was likely to re-open. In his second case this error was avoided by closing the pylorus in the same manner as above. This patient had rather acute and severe symptoms indicating an ulcer, and upon operation, a small, indurated ulcer was found on the anterior surface of the first portion of the duodenum. The pyloric opening was quite large. The pylorus was closed as in the first case and a posterior gastro-jejunostomy performed. This operation was done ten weeks ago and the result thus far had been perfectly satisfactory.

While this method was not a new procedure it was used in these cases in a somewhat modified form after a suggestion made to him by Dr. Martin. The permanency of this method of closing the pylorus was still doubtful. Of course, as experience had shown, such an accessory to a gastro-enterostomy was often unnecessary as is shown in the next case.

CASE III. *Benign Stenosis of Pylorus following Subphrenic Abscess Due to Perforated Duodenal Ulcer.*—In this case there was a firm, cicatricial, contracted pylorus, which suggested little likelihood of dilatation. The patient had been operated on in February, 1912, by Dr. Charles H. Peck, for a large subphrenic abscess, the incision being made along the free border of the right costal arch. The patient stated that after this wound had completely healed, in April, 1912, he began to have pain in the epigastric region, with vomiting once or twice daily. The vomitus consisted of food and mucus; he had never noticed any blood.

This condition continued for perhaps six months, when he began to vomit after each meal. He could practically retain no food, and became much emaciated and weakened.

Operation, February, 1913, revealed a hard, cicatricial area involving the first portion of the duodenum, which was imbedded in dense adhesions. A gastro-enterostomy was done, with entire relief of symptoms.

CASE IV. *Excision of Duodenal Ulcer with Pyloroplasty.*—In the last case shown by Dr. Pool, a young man who was operated on in July, 1912, it was decided to do a pyloroplasty with excision of the duodenal ulcer in preference to a gastro-enterostomy, the normal anatomical conditions thus being more nearly preserved, two outlets from the stomach being avoided and the stomach being adequately drained. This procedure was planned to meet the surgical indications in a certain type of duodenal ulcer. Its aim was the excision of the ulcer, with enlargement of the lumen of the pylorus. It was thought that for the reasons already enumerated it might be employed advantageously in dealing with certain small ulcers on the anterior wall of the duodenum near the angle of approximation in a Finney operation. Its trial in this case had proven only partially satisfactory, and Dr. Pool said he would hesitate to resort to the procedure again on account of the likelihood of the etiological factor, which had given rise to the first ulcer, continuing to act and resulting in the development of further ulcers. The patient did well for a time, but for several months past he had suffered from considerable pain in the epigastrium several hours after eating. This pain was relieved by taking a cup of tea or hot water. His general condition, however, had improved greatly; he was now able to eat anything and was not subject to belching and vomiting as he was prior to the operation. His symptoms, however, suggested the development of another ulcer.

DR. ARPAD G. GERSTER said he had under his observation at present a patient upon whom a gastro-enterostomy was done for an ulcer in the vicinity of the duodenum. The posterior operation was done, and the antrum pylori was constricted. That patient improved very much after the operation, but returned six months later complaining of his former symptoms, and upon examination, a palpable tumor was made out. When the abdomen was reopened it was found that in spite of the presence of the ligature,

the patency of the pylorus had been re-established, and a large mass involving, apparently, the stomach, duodenum and transverse colon was made out. This was feared to be malignant, but as a peptic ulcer could not be excluded, the speaker said he advised Dr. A. A. Berg, after some consideration, to do a jejunostomy, after which the patient's condition immediately began to improve, doing so well, in fact, that the suspicion of carcinoma was practically discarded while that of a peptic ulcer was rendered more probable.

At the last meeting of the Society, Dr. Gerster said, Dr. Lilienthal presented a case where a Finney operation was done, in 1908, for a benign stenosis of the pylorus. The symptoms recurred, and four years after the primary operation, when the abdomen was re-opened, the stoma made by pyloroplasty had shrunken to such an extent, that it was scarcely possible to insert the end of a probe. To-night, Dr. Pool showed a somewhat similar case, which simply went to show that the Finney operation did not possess a very decided advantage over the ordinary pyloroplasty, and he wished to emphasize what he has said at the last meeting, namely, that this operation did not do away with the vicious tendency to hyperacidity which gave rise to the ulcers.

At a recent meeting of the Deutsche Gesellschaft in Berlin, the question of whether or not to exclude or tie off the pyloric end of the stomach gave rise to a very lengthy and interesting discussion. Some were strongly in favor of this procedure, notably von Eiselsberg, who advocated complete division of the stomach, while others, more especially Koch, said that they never practised exclusion of the stomach, and their results seemed to be better than by any other method. No satisfactory conclusion could be arrived at, however, and the matter was left undecided.

Dr. Pool said that in his fourth case, to which Dr. Gerster had referred, he had no reason to believe that the Finney pyloroplasty had contracted, but what he wished to emphasize was that the recurrence of the characteristic pain was suggestive of the development of another ulcer in the duodenum.

FRACTURE-DISLOCATION OF THE SHOULDER.

Dr. William Darrach presented a woman, forty-six years old, who on January 24, 1911, fell with her arm behind her back, striking on her shoulder. A month later she came to the Out-

Patient Department with signs of a dislocation of the shoulder, which were verified by the X-ray. There was at this time complete deltoid paralysis, with anæsthesia over the region of the circumflex.

Reduction under anæsthesia having failed, an open operation was done 35 days after the injury, when it was found that the muscular attachments had been torn from both tuberosities, and the head of the humerus had been dislocated to the subcoracoid position. A shell of bone, with the subscapularis attached, lay against the glenoid, preventing reduction. When this was pulled aside, the head seemed to enter the glenoid cavity, and after suturing the lesser tuberosity in place, the wound was closed. Primary union resulted, but the X-ray showed that the head was still out of the glenoid. The wound was re-opened three weeks later, when it was found that the muscles had also been torn from the greater tuberosity, taking some of the bone with them, and that the head of the bone had originally been forced through this upper rent in the capsule. In the previous reduction the head had been forced through the opening made by the tearing off of the lesser tuberosity, so that the long head of the biceps and a strip of capsule were wrapped around the neck. These were unwound, and the head made to enter the proper opening. The subscapularis was again sutured to the lesser tuberosity, and an attempt made to bring the spinati to their normal attachment with chromic gut. The wound was closed, and the arm put up in abduction.

The operation was very difficult and prolonged, and the gloved finger was introduced several times into the wound. The temperature reached 101.4° on the second and third days; then fell to normal and remained so. The wound was dressed on the eighth day, when half a drachm of thick, yellow pus came from the region of the pectoral muscles. This drained freely for a time, the skin finally and permanently closing 36 days after operation. No attempt was made to investigate the circumflex nerve at either operation.

At the present time, three years after the operations, the head of the bone was in place and there was full range of passive motion. The deltoid, however, was completely paralyzed, with marked interference with the function of the joint. The spinati had apparently maintained their attachment, as there was about

10 degrees of active abduction, and the supraspinatus could be felt contracting during this act. With passive abduction there was 90 degrees of active rotation. The patient was unable to fix her hair unless she leaned over. She was able to fasten her waistband in the back, and do washing and ironing, but was unable to scrub floors. There had been no evidence of osteomyelitis or arthritis.

FRACTURE OF THE RADIUS: LOWER SHAFT.

DR. DARRACH presented a man, thirty-eight years old, who five days before his admission to the hospital fell fifteen feet, fracturing his left lower radius. After several unsuccessful attempts at closed reduction, an operation was done on February 22, 1913. The upper end of the lower fragment was found anterior and to the ulnar side, a fragment of muscle being interposed between the broken ends. There was 90 degrees of rotary deformity. A 4-screw vanadium steel plate was applied, and the wound closed tight. The operation was of longer duration than usual, owing to a number of technical difficulties, but the most careful Lane technic was observed throughout. The patient's temperature rose to 102.2° on the second and third days; then it became normal and remained so until the tenth day, when it again rose to 102°. The wound was not dressed until the following day, when the stitches were removed, and owing to slight redness and puffiness the skin edges were separated and at least three ounces of creamy pus were evacuated from the deeper space. There was no odor to the pus, and remarkably little swelling of the forearm. A culture taken from the pus was negative. The wound was opened widely and packed with formalin gauze. It drained freely for a few days and healed at the end of twenty-four days. Twenty-one days later the scar was excised and the plate removed, all four screws still holding firmly without any signs of exudate. The bone under the plate was smooth and shining, with no evidence of repair on that side of the bone. The rest of the circumference of the bone was not disturbed. The wound was closed without attempting to remove the blood, hoping that the clot would hasten repair. The stitches were removed on the eleventh day, with firm union and without redness. Fourteen days after the second operation a blister appeared, which was opened and about half a drachm

of clear serum expressed. There was still motion to be felt at the site of the fracture, eight and a half weeks after the original injury.

OPEN OPERATION FOR FRACTURE OF THE CLAVICLE: MIDDLE THIRD.

DR. DARRACH showed a man, forty years old, who on January 30, 1913, fell, striking his left clavicle against a corner of stone. He was treated at several hospitals and dispensaries, first with a Velpeau and then with a Sayre. While the latter bandage was in place he complained of anæsthesia over the ulnar aspect of the hand, with loss of power in his fingers. He was admitted to the hospital twenty days after the receipt of his injury and an operation was advised, but it was postponed for a week, as he was running a little temperature, due, apparently, to pulmonary conditions.

On March 1, 1913, an open reduction was done, and a 4-screw vanadium steel plate applied, the Lane technic being carefully observed. The dressing was changed on the third day, as his temperature had ranged between 100° and 101.2°. There was a little puffiness at one point of the wound, and on separating the skin edges, perhaps five drops of what looked like melted fat were evacuated. The wound was swabbed with Churchill's tincture of iodine; it healed without further discharge and had remained closed since. A culture of the discharge showed staphylococcus.

At the time of the operation, the inner end of the outer fragment was found to be pressing on the lower portion of the plexus. One of the screws inserted in the bone plate became loosened, allowing a slight displacement, but the general position of the bone remained good. The bandages were finally removed at the end of 26 days. The local anæsthesia had disappeared, and the muscles were beginning to contract feebly. There was still a good deal of limitation of motion in the entire extremity, which was decreasing under massage and passive motion.

Dr. Darrach reported one other case of a badly lacerated, compound, comminuted fracture of the tibia and fibula where the plate had to be removed because of infection. In that case, the sinus persisted for about six months. It remained healed for six months, when he died six weeks after an abdominoperineal proctectomy for carcinoma.

Dr. Darrach said that of his series of 144 cases of open operation for fractures and dislocations, infection had followed in five, which included the compound case reported to-night. Two of these infections had occurred before they had adopted the Lane technic, which they now try to carry out in all cases. In one case of infection occurring since then, it could be traced to a break in the technic. In two later cases no cause for the infection could be found. The number of cases of infection given above did not include three cases where chromic gut was discharged at a late period, nor two cases where phosphor bronze wires were removed, as they were threatening the skin.

Dr. Gerster said he was glad to see the cases shown by Dr. Darrach, as they served to illustrate the fact that the open method of treating fractures with a plate or pin or otherwise, which had recently become so popular among surgeons, was by no means a simple procedure and in many instances might result in injury or even loss of life. At the Mt. Sinai Hospital, where fracture cases were comparatively rarely admitted, about 25 cases had been treated by the open method, and Dr. Gerster then reported in detail one case of fracture of the radius in a young man, apparently in perfect health, where, in spite of every possible aseptic precaution, the open method of reduction was followed by rapid and fatal sepsis.

ENDARTERITIS OBLITERANS RELIEVED OF SYMPTOMS AND FUNCTION BECOMING RESTORED IN CONJUNCTION WITH THE USE OF THE SCHNEE FOUR-CELL ELECTRIC BATH.

Dr. William C. Lusk presented a case of endarteritis obliterans, the history of which was as follows:

Male, age thirty-five. Onset of present disease early in 1901. For the previous 9 years he had worked as a carriage trimmer and operated a heavy sewing machine with his feet. The first symptom was a cramp in his left calf, coming on during walking. The cramp increased in frequency until at the end of 6 months he could walk only about one block. At this time he began to have a burning pain over the dorsum, and in the toes, of the left foot, especially in the big toe, which stopped his walking. The big toe got blue. The big toe-nail was removed for "ingrowing toe-nail" without relief. He was treated in a hospital with wet carbolic

(2 per cent.) dressings for 9 weeks. The great toe became black and was amputated and the pain was considerably relieved. The wound did not heal. Two months later (July, 1902) the pain recurred. In the next year and a half the patient was treated at dispensaries, he suffering great pain and getting around on crutches. In February, 1904, he was admitted to Bellevue Hospital where he remained for 13 months. In the summer of 1904, all the remaining four toes of his left foot dried up and dropped off. On October 15, 1904, the foot was amputated (Pirogoff's amputation) by Dr. Bryant, resulting in complete relief of the pain. About a year later the patient returned to his former occupation again, plying the same heavy sewing machine, but now with his right foot only, he wearing a left artificial leg.

He was then well until November, 1910, when his right calf began to cramp when he walked. He now gave up the use of the foot-power. The cramp grew progressively worse and about November, 1911, he began to have a burning pain in the great and little toes, much worse in the latter, of the right foot, which he characterizes as "awful" and "something terrible." A little later there developed in his little toe and outer side of the sole of his foot a "freezing" pain which was much less endurable than the burning pain. In December, 1911, the great and little toe-nails fell off. Early in January, 1912, no arterial pulse could be felt in the right leg and the circulation was poor. The patient then entered St. Vincent's Hospital where he was treated with heat and Bier's hyperæmia, an elastic bandage being applied around the thigh daily for 20 minutes, sufficiently tight to cause slight venous congestion. Bier's negative pressure previously applied to a case somewhat akin to this one, by Dr. George D. Stewart, had been followed by relief of the symptoms. After 5 weeks of treatment with the elastic bandage, there was in this present case little or no pain remaining, the foot was no longer cyanosed when it hung down, and the patient was sleeping well. The patient was then free from pain until July, 1912, the great toe-nail in the meantime having grown again.

With the recurrence of the symptoms he again entered St. Vincent's Hospital, the end of last August. The use of the elastic constriction again, combined with mixed treatment, now gave no relief whatever. The patient suffered severely again from what he termed the "freezing pain" which affected the little toe

and outer portion of the sole of the foot, which sites were always those of the greatest pain. There was also the "burning pain" in the great toe and in a small area on the dorsum of the foot at the bases of the first four toes, and in another area in front of the outer portion of the ankle-joint. The foot became cyanotic, at least in the painful areas, when it hung down. The small ulcer resulting from the loss of the little toe-nail in December, 1911, still existed. It did not lead to bone. Finally on November 10, 1912, treatment with the Schnee[1] four-cell electrical bath was instituted. This bath (Fig. 1) consists of four porcelain tubs filled with water, in which the extremities are immersed, the water being electrified through the medium of carbon or metal electrodes, those of the foot tubs being connected to the positive pole while those of the arm tubs are connected with the negative pole. This treatment was known to cause an erythema of the skin of the submerged portions of the extremities during the passage of the current, and its continued use was reputed to produce a gradual improvement in the circulation of the extremities, so that it was deemed worthy of a trial. The current was taken from a fixture through a rheostat.

The patient had had to date (April 23) 156 of the electrical baths, which treatment had been attended with a variety of effects. The current at the beginning was used at 20 ma. but in two or three days was established at 30 ma. for 10 minutes. During the first month the improvement was marked and the patient became practically free from pain. On December 9, however, he had a sudden return of the "freezing pain" in and around the right little toe, which attack lasted about 12 hours. At the same time a "drawing pain" developed at the inner side of his leg, which he had had at a previous time. After this the pain would come on in attacks alternating with periods of intermission. At this time the pain would always be arrested or eased for a number of hours consequent upon taking the bath. Thus on December 14, 1912, after a bath at 1.30 P.M., the pain was eased until midnight. On December 15, 1912, the bath was omitted and his pain the following night he described as "awful." Immediately after his bath on December 16 the pain all left and that night he slept 8 hours. Later, however, at a time when the skin seemed to have

[1] A. Schnee: Das elektrische vier-zellen Bad. Medicinische Blätter, xxx, 1907, p. 519.

FIG. 1.

The Schnee four-cell electric bath used in the treatment of a case of endarteritis obliterans. The current is taken from a fixture through a rheostat. The positive pole is connected with the electrodes in the foot tubs, and the negative pole with the electrodes in the hand tubs. A current of 30 ma. for 10 minutes, used at the beginning with favorable result, later caused pain, so that the strength had to be reduced to 10 ma. for 10 minutes to obtain the proper therapeutic effect.

grown more sensitive to the electrical stimulation, with the same strength of current a marked augmentation of the pain would come on during the bath, so that the current had to be reduced considerably to re-establish the therapeutic effect of the treatment. On December 11, 1912, the patient made the observation that the nails and hair of his toes had begun to grow again after a period of indolent growth, in the previous two years he having been obliged to cut his toe-nails only 2 or 3 times, whereas in the past month he had cut them twice. On January 9, 1913, it was recorded that in the day-time when the patient sat with his right leg flexed and foot in a chair, the pain did not bother him, but as soon as he lay down the pain would start up. Warmth was always grateful and he usually sat close to the radiator. The foot and leg were kept wrapped in cotton and a fur-lined shoe was worn. On this date it was discovered that the baths were being given with the negative wire attached to the foot tubs and the positive wire to the hand tubs. The patient was sure that this disposition of the wires had not varied from the beginning of his treatment, yet it was known that the direction of the current was originally started right. The poles were forthwith connected with their proper electrodes. On February 1 it was recorded that since the readjustment of the poles, on January 9, the improvement had been progressive. The patient was still comfortable in the day-time, and at night the pain would come and go at intervals so that the patient could usually get 3 or 4 hours of sleep. Jumping of the leg at night had been arrested by a plaster splint. Raising the head of the bed seemed to diminish the pain at night.

During the latter part of January the patient began to notice that there was an increased sensitiveness in his legs to the electrical stimulation in the bath, which increased to such an extent that by the middle of February the bath after the first 4 or 5 minutes actually excited pain in the right foot, so that on February 17 the strength of the current was reduced to 20 ma. On February 24 it was recorded that the pain not only continued to be excited by the baths, but it was now excited also by walking "even by two steps." The pain, which was intermittent, lasting about 1½ hours and then arresting for about 1½ to 2 hours, was now worse in the day than at night. It affected chiefly the little toe and the outer side of the sole of the foot. On February 25 the bath was omitted and the pain was worse.

On February 26 a test was made with the bath to see how long a current of 15 ma. could be used before it would excite pain. The pain came on with this strength of current in 13 minutes, at the expiration of which time the bath was discontinued. The pain after this bath lasted only ½ hour and the patient was then comfortable for the rest of the day and slept all of the following night. The baths were then given, using a current of 15 ma. for 15 minutes, with which treatment the attacks of pain were less severe, but they still excited some discomfort so that on March 1 the current was further reduced to 10 ma. and the time to 10 minutes. From this time on improvement progressed unabatedly and rapidly. The attacks of pain became shorter and less severe and the intervals longer. On March 6 the pain after walking lasted only 15 to 20 minutes and was not very severe. Then during a cold snap the pain increased. The patient had his last severe attack of pain on March 15, which lasted 3 hours, after which the attacks of pain became hardly noticeable and then, excepting for a very slight attack of pain on April 10, disappeared entirely the latter part of March. About April 1 the patient gave up the use of his cane. The administration of mixed treatment in conjunction with the baths was studiously limited, it having been allowed only for one day, the end of February, and again for not more than a week, early in March.

At the present date, the foot is no longer cold; the ulcer on the little toe has healed all but for a small opening which just admits the extremity of a probe; (the variations in the color of the toes had not at this time been noted; cyanosis affected most noticeably the dorsum of the little toe); the muscles of the leg have been developing; the patient walks short distances quite easily though a little stiffly. This stiffness in gait, together with a little soreness around the ankle-joint during locomotion, seem to be only accompaniments of the bringing into use again of long disused parts. The ankle-joint itself has complete normal mobility. Since February 11, the patient has gained 7 lb. in weight.

NOTE.—May 14, 1913. The baths, using 10 ma. for 10 minutes have been continued. The soreness on locomotion is nearly all gone and the patient walks more easily. For two weeks preceding May 9 the patient had been sleeping 9 to 10 hours every night. Since May 5 the patient has been troubled with a burning sensation, for the most part momentary in duration and coming on

chiefly after going to bed, on the dorsum or at the base of the little toe, on two nights it waking him from his sleep for a few minutes at a time, and on another night (May 12) it making him quite restless. Twice in this period of time, with the occurrence of a little swelling of the little toe, a drop of retained pus was let out from the diminutive sinus in this toe.

The color of the toes has recently been made a matter of observation. The little toe is the one most liable to cyanosis. This toe, with the patient standing, has been seen to spontaneously change in color from bluish to a brilliant rose. The toes, on three successive days, have become a little dusky following moderate exertion in the morning, before the bath, but after the bath there seemed to be little tendency to cyanosis with ordinary exertion. On the morning of May 13 before the bath, after walking 50 feet, all the toes were slightly dusky, but after the bath, during the afternoon, more than one hour of which was spent in slow walking around and standing, the toes were found at each of several observations, to be always a good red color, excepting for a very faint bluish tinge around the scar on the little toe. Standing heavily on the right foot, however, toward evening, produced duskiness of all the toes within three minutes.

In a second case of endarteritis obliterans the treatment of which has just been begun, after the first electric bath (20 ma. for 10 minutes) the patient was entirely free from pain for 5½ consecutive hours, whereas previously the intervals of relief had been of no longer duration than half an hour, and after his second bath (10 ma. for 10 minutes) the relief from pain lasted 9 hours.

RECTUS TRANSPLANTATION BY A SPECIAL TECHNIC.

Dr. William C. Lusk said he presented this case for the purpose of bringing up for discussion the question as to what was the best technic for performing Bloodgood's operation of transplanting the rectus muscle.

He said the patient was one in the service of Dr. Bissell at Bellevue Hospital; that he had a recurrent inguinal hernia which was direct, and that repair was effected in accordance with the technic shown in the illustration and described herewith, excepting that the outermost stitch in the rectus sheath also included the rectus muscle instead of there being separate stitches at this situation; that the patient was operated on November 30, 1912, and

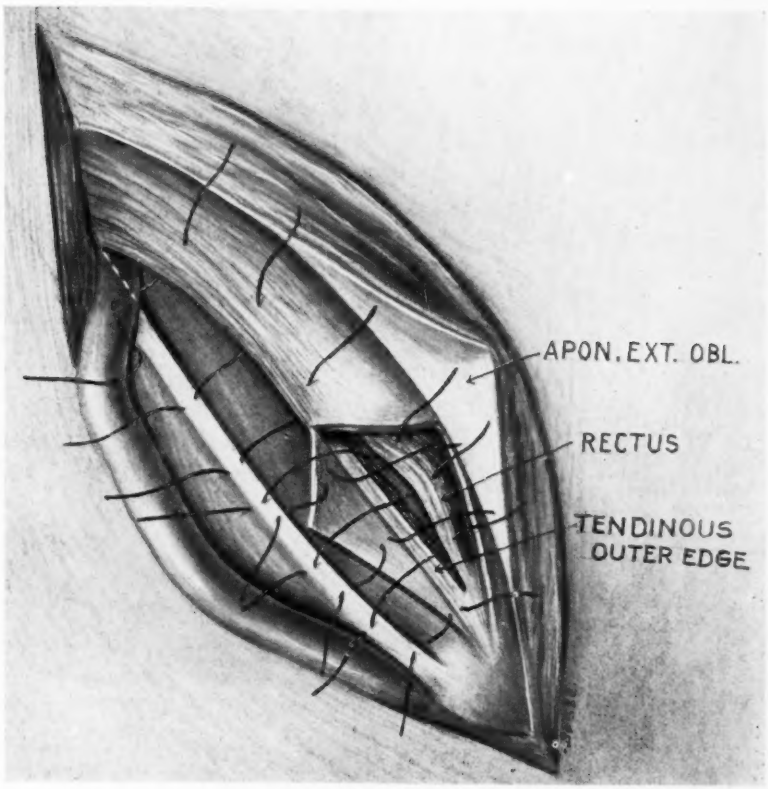
returned to his work, which was that of a motorman, on a trolley car, 5 weeks later, in which occupation he had been actively employed since, using the hand break of the trolley most of the time. The abdominal wound was at the present time solid.

Dr. Lusk said he had for a good many years practised entering the rectus sheath in front through the portion internal to the conjoined tendon after first raising therefrom the overlying aponeurosis of the external oblique. To enter the rectus sheath from behind working beneath the muscles, had always seemed to him to be an awkward procedure, and, in the presence of an intact transversalis fascia in the floor of the inguinal canal, inadvisable.

He said that formerly he had used a low vertical opening in the front of the rectus sheath beneath the aponeurosis of the external oblique, extending down to the pubic crest, with which technic the rectus was usually drawn out laterally under some restraint. Recently he had added to the vertical cut at its upper extremity, a transverse cut, dividing the sheath out to its outer edge, which step in the technic he wished to call especial attention to. By cutting the flap in this way in the shape of a right-angled triangle, the sheath was laid open out to its outer edge so that the rectus muscle could be liberated from its intramural attachments under guidance of the eye, and its lateral displacement was no longer restricted by the sheath. Another advantage of this anterior triangular flap method he said was, that the sewing of the everted flap to Poupart's ligament interposed another layer to replace the deficient conjoined tendon. This line of union should be effected by a separate row of stitches. It was easier to make the transverse cut first and follow it with the vertical one. The sutures in the flap made from the sheath should catch Poupart's ligation near its deep border which was more or less rigidly held, while those in the rectus muscle should catch Poupart's ligament through its more superficial fibres, which had some mobility and would therefore be drawn upward to meet the rectus partway as the sutures were tied. In the repair the aponeurosis of the external oblique directly overlay all that portion of the transplanted rectus which was situated above the level of the transplanted cord, thus in large part supporting the area in the front of the rectus sheath from which the triangular flap had been cut.

As regarded the surgical anatomy, Dr. Lusk said that the outer

FIG. 2.



This technic represents only what has already been done by others. Wölfler (*Beiträge z. Chir. Festschrift f. Th. Billroth*, 1892), who was the first to transplant the rectus muscle, did it through an anterior opening in the sheath. Halsted (*Johns Hopkins Hospital Bulletin, August*, 1913), in 1899, originated the turning over of a flap cut from the aponeurosis covering the front of the rectus muscle with suture of the same to Poupart's ligament, to close the lower part of the inguinal canal. Berger (*Revue de Chirurgie, January*, 1902) also originated a similar flap for the repair of inguino-interstitial herniæ. Bloodgood, with whom transplantation of the rectus muscle was also original, originally transplanted the rectus muscle through a posterior incision in its sheath (*Johns Hopkins Hospital Reports*, vii, 1898–99) but later adopted the triangular flap from the front of the rectus sheath devised by Halsted, and then transplanted the rectus muscle through this anterior opening in the sheath, sewing the flap from the sheath and the rectus muscle each to Poupart's ligament by a separate row of sutures (*Internat. Clinics*, 18th Series, vol. i, 1908, p. 296). In this dissection the outer edge of the rectus muscle was tendinous and closely attached to the posterior layer of the sheath, and was therefore split through instead of dissected free, in order to raise the belly of the muscle.

edge of the rectus muscle in the operative field was usually adherent to the posterior fascial layer of the rectus sheath, frequently by a tendinous attachment but sometimes only by fascia; and that when this attachment was a tendinous one, then to raise the muscle out of its sheath the outer border must be split through instead of dissected free, since to dissect it free would necessitate cutting through the posterior fascial layer of the sheath, thus impairing the support given by the latter fascia. He said that the transversalis fascia forming the posterior layer of the rectus sheath was generally a structure of much firmness, which, when firm, would give support to a poorly developed rectus muscle transplanted through the anterior route. In 5 out of 6 dissections on 6 cadavers, the posterior layer of the rectus sheath was one of considerable strength, but in one cadaver there was found in it at a situation a little above the pubic crest, a small area of weakness which offered but little resistance to the finger pressed through it from behind.

RECTUS TRANSPLANTATION FOR DEFICIENCY OF THE INTERNAL OBLIQUE MUSCLE IN CERTAIN CASES OF INGUINAL HERNIA.

Dr. William A. Downes said that at a meeting of the Society held at the New York Hospital over two years ago, he described a method of rectus transplantation which he had now employed in about 165 cases during the past four years. Of this total number of cases he had been able to keep trace of about 60, and in only one of those had there been a recurrence. All of these cases were either of the direct or combined indirect and direct variety. Although the method he had described was more complicated and necessitated more handling and dissection of the tissues, he has never seen infection occur.

Dr. William B. Coley said he agreed with Dr. Schley in regard to the necessity of transplanting the rectus muscle in every case of direct hernia and in certain cases of indirect hernia. There were various methods of doing this since that first described by Bassini, and later by Wolfler and Bloodgood. Personally, Dr. Coley said, he favored that of Dr. William A. Downes, which had the particular advantage of placing two different layers of sutures under the cord, whereas with the other methods there was only a single layer. The speaker said he had followed this method in a

large number of cases, without having seen a single recurrence thus far.

Dr. A. V. Moschcowitz said that in spite of the employment of so-called radical methods for the cure of hernia, recurrences were occasionally seen even in the hands of the best of operators. The speaker said he had been watching very carefully for the cause of such recurrences, and he had come to the conclusion that they were not due to failure to transplant the rectus. His investigations had shown that by the time the recurrence took place, the question of whether the original operation was a Bassini or a Coley or a Halsted had lost its import—it was something entirely different. In most of the cases where a recurrence had taken place he had found that the conjoined tendon or united internal oblique and transversalis had become entirely separated from Poupart's ligament, and that the fault manifestly lay with the suture material.

Dr. Moschcowitz said that three or four years ago, before a meeting of the Surgical Section of the N. Y. Academy of Medicine, he made the statement that the choice of a suture material in these cases made little difference. Since then he had changed his views on that point, and he now believed that an absorbable suture material in these cases became absorbed before the muscles had time to properly unite with Poupart's ligament. Personally, he was now doing all operations for the cure of hernia with silk or Pagenstecher sutures, and his results were much more satisfactory than formerly.

Dr. Robert H. M. Dawbarn said that while he agreed with Dr. Moschcowitz that the cause of the recurrences in these cases was the separation of the conjoined tendon from Poupart's ligament, he did not believe that the explanation for the separation lay in the use of a non-absorbable suture material. Even in the description of Bassini's original technic—which the speaker said he had recently reviewed—nothing was mentioned of the extreme importance of loosening the conjoined muscle, both as to its superficial and deep surfaces so that there would be an entire absence of tension. In his own work, Dr. Dawbarn said, he made it a rule to strip the conjoined muscle until it practically rested down against Poupart's ligament without any tension. In surgery, as in matrimony, an unwilling union was apt to be followed by divorce.

More than twenty years ago, the speaker said, Dr. Willy Meyer

wrote a paper in which he reported his experiments with the use of silk, cotton and linen sutures, and referred to the advantages of the latter as a suture material. Practically, since that time, Dr. Dawbarn said, he had discarded silk and had substituted linen. He understood that the Mayos were also using linen of late, in all abdominal work. Originally the strongest of the three suture materials named, linen is not, like silk, weakened by the necessary boiling for sterilization; and as Dr. Meyer proved that all three are equally well tolerated by the bodily tissues, there seemed left no excuse for employing silk.

A point worthy of remembrance, Dr. Dawbarn added, is that both linen and silk, when the smaller sizes are used, are capable of being absorbed and disappearing; but this only after a much larger period of time than any kind of material requires, ordinarily classed as "absorbable."

Dr. L. W. Hotchkiss said that Halsted did not transplant the rectus muscle, but he turned over the transversalis flap from its anterior sheath, and joined it to Poupart's ligament. He did not use the muscle because he did not believe it would hold.

Dr. Coley said that he could not let the opportunity pass without saying a few words in the defence of absorbable sutures in hernia operations. Many years ago, the late Dr. Wm. T. Bull, together with the speaker, published a series of cases of hernia in which various kinds of non-absorbable sutures had been used with serious after-results in the way of sinuses and prolonged suppuration. In one case with primary union, in which silkworm gut had been used, a sinus developed at the end of six months, another 2½ years later and a third 3 years and 8 months after operation. Not until all the sutures had been extricated did the sinus formation cease. (In this case the long-continued suppuration resulted in a recurrence of the hernia.) Similar results were seen following the use of silk and silver wire. The speaker said that he believed that the statistics of the Hospital for Ruptured and Crippled, covering a period of 23 years and including nearly 4000 operations in which chromicized kangaroo tendon had been used with less than 1 per cent. of relapses, were sufficient to prove that non-absorbable sutures were unnecessary in hernia operations. Dr. Coley stated that any suture that remained in the hernial canal unabsorbed longer than 3 to 4 weeks did harm rather than good. If there was any tension upon a suture after this period, such

suture would cut through until there was no longer any tension, and then it would act as a foreign body. He stated that, within a single year, he had recently operated upon two cases in young adult women, for sinuses following an operation, developing a year after the introduction of silk sutures, at two of the leading German Clinics.

Dr. Moschcowitz said he did not wish to imply by his remarks that permanent sutures were necessary, but that it was important to choose a suture material that would last longer than did chromicized catgut. It took longer than twenty or twenty-five days to get union between the conjoined tendon and Poupart's ligament. In reply to the remarks of Dr. Coley, he would say, that he knows, that Dr. Coley uses kangaroo tendon as suture material, which may more properly be classed among the unabsorbable sutures.

Dr. Gerster said that perhaps twenty-five years ago he used silk exclusively as a suture material and for a time found it very satisfactory, until he had a series of infections which were traceable to imperfect technic in the preparation or handling of the sutures. Since then he had relied on chromicized catgut. At his division at Mt. Sinai Hospital, where hernia cases were operated on by five different surgeons, results, on the whole, had been very favorable. Personally he did not entirely accept the explanation given by Dr. Moschcowitz for occasional recurrences, and was inclined to attribute them, not so much to the technic or to the suture material, as to the natural tendency of the tissues of some patients to be non-resistant and flabby. Such tissues give way easily. With the very first stroke of the knife we could often recognize this inherent quality of the tissues—whether friable or tough. Some tissues tore readily, and it was probably this quality that was responsible for the original development of the hernia. While there were other factors, no doubt, this was one of the features that should not be disregarded.

Dr. Lusk said that since the last meeting of the Society, when his case of transplantation of the rectus muscle by a special technic was first briefly described by him, he was told by Dr. Hotchkiss that he likewise had for some years practised suturing a flap from the front of the rectus sheath, as well as the rectus muscle, to Poupart's ligament, and that the operation was original with Drs. Halsted and Bloodgood. Dr. Lusk said that in the meantime Drs. Halsted and Bloodgood had kindly supplied him with the

literature on the subject. Wölfler (*Beiträge z. Chir. Festschrift f. Th. Billroth,* 1892, p. 552) was the first to transplant the rectus muscle, which he did through an anterior opening in the sheath. Bloodgood (*Johns Hopkins Hosp. Bulletin,* May, 1898, and *Johns Hopkins Hosp. Reports,* vii, 1898–99) without previous knowledge of Wölfler's operation transplanted the rectus muscle through a posterior opening in the sheath. Then Halsted (*Johns Hopkins Hosp. Bull.,* August, 1903), in 1899, in a case in which the internal oblique was "fatty and attenuated," used for the first time a part of the aponeurosis covering the rectus muscle to close the lower part of the inguinal canal. After 3 years the closure was still solid. Berger (*Revue de Chirurgie,* January, 1902) almost simultaneously with Halsted sewed a flap taken from the front of the rectus sheath to Poupart's ligament, in operating for inguino-interstitial herniæ. His flap was 8 to 10 cm. in length, and to support the area weakened by the cutting of so large a flap, the outer edge of the rectus muscle was sutured to the displaced outer edge of the sheath, and the relaxed overlying aponeurotic structures were apposed by a special plastic procedure. Afterward Bloodgood (*Internat. Clinics,* vol. i, 18th series, 1908, p. 296) revised his method of rectus transplantation, adopting the triangular flap from the front of the rectus sheath devised by Halsted, transplanting the rectus muscle now through this anterior opening in the sheath, and suturing the flap from the sheath and the rectus muscle each to Poupart's ligament by a separate row of sutures.

Regarding tension on the sutures uniting the internal oblique fibres to Poupart's ligament in indirect herniæ, Dr. Lusk said that Dr. Halsted (*ibid*) overcame this difficulty when present, by a vertical relaxation cut through the front of the rectus sheath.

Dr. Schley, in closing, said that what he wanted to emphasize was that the amount and extent of internal oblique muscle should determine the method of operation. The indication for rectus transplantation or transposition was deficiency of the internal oblique of such a degree that proper protection could not be secured with the straight Bassini. In certain cases where enough oblique muscle was present to be worth utilizing internal to the transplanted cord the combined operation was of value. In *marked* oblique deficiency the rectus sheath could be opened anteriorly, by the method he had spoken of, a quick simple procedure.

He was not in favor of using a non-absorbable suture when the absorbable would do the work and then disappear.

LYMPHOCELE SIMULATING FEMORAL HERNIA.

Dr. William B. Coley presented a boy, nineteen years old, who consulted him on February 21, 1913, with the history of having always been in good health up to two years ago, when he noticed a small swelling in the right femoral region. This had gradually increased in size and had never been reducible either on lying down or on pressure. It had never caused any pain. He had been examined in the out-door department of one of the leading hospitals in New York a few days before, and the condition was pronounced a femoral hernia by two surgeons, who advised an operation.

Examination showed a tumor in the right femoral region, two by three inches in diameter, situated directly over the femoral opening. The tumor extended outward, over and beyond the femoral vessels, and downward about three inches. The overlying skin was normal. The tumor was irreducible on pressure. There was no direct impulse on coughing; only a transmitted impulse. Palpation showed the swelling to be unlike that of a femoral hernia, in that, instead of a single pouch or sac, it appeared to be made up of a series of small lobules or cysts, and gave an impression not unlike that of a lipoma. The lobules were more or less loosely connected.

Dr. Coley said that while he felt positive that the condition was not a hernia, he was uncertain as to its actual nature, but he was inclined to believe it was a lipoma, and advised operation. After twenty-four hours rest in bed there was a considerable decrease in the size of the tumor, which added still more to the uncertainty as to its nature. Upon incision, he found a tumor made up of numerous small cysts or dilated lymph spaces extending up to the femoral canal. As many as possible of these were removed and the wound was closed without drainage. It healed by primary union.

After the patient left the hospital the swelling soon reappeared and had steadily increased in size until at present it was nearly two-thirds as large as it was at the time of the operation.

Dr. Coley said that in nearly 100,000 cases of hernia observed at the Hospital for the Ruptured and Crippled since 1890, no similar case had been seen, so far as he was aware.

Dr. Henry H. M. Lyle said that at a meeting of the Society

in October, 1912 (vol. lvi, page 942), he showed a case of bilateral femoral adenolymphocele of filarial origin. The patient was a negro, twenty-one years old, from St. Kitts, West Indies, who four years previously had noticed a lump in each groin. The swellings were soft, painless, disappearing on lying down and reappearing on standing. During this time he had also suffered from periodical attacks of pain in the lower abdomen, and during one of these he was operated on for acute appendicitis in some hospital in this city. He obtained no relief from the removal of his appendix. There was no history of chyluria. The periodicity of the attacks had led to the diagnosis of malaria, while the abdominal pain had suggested appendicitis, diverticulitis, etc. Later, with greater prominence of the femoral swellings, the diagnosis of femoral hernia and strangulated femoral hernia were made. Upon further examination, however, and after several blood tests, microfilaria were found in the blood, and the diagnosis of adenolymphocele was made and the glandular masses in both groins excised. The lymphatics were greatly enlarged and it was found necessary to tie and cauterize a number of the lymphatics to check the escape of fluid. The wounds healed by primary union and there was no resulting lymphorrhœa nor elephantiasis.

Dr. Lyle said that upon looking up this subject more thoroughly, he felt that the best method was to avoid operating in these cases.

Dr. Darrach said he recalled one case where upon operating for a supposed inguinal hernia they found a large mass of lymphatics instead. The filarial organisms were not discovered in that case.

TRAUMATIC ERB'S PALSY IN ADULTS.

Dr. Alfred S. Taylor and Dr. Louis Casamajor read a paper with the above title for which see page 577.

Dr. F. Kammerer said his experience with three cases of Erb's palsy had been a rather discouraging one. In all of his cases there was avulsion of the brachial plexus. One was that of a young man who fell from his bicycle, striking on his head and shoulder. The second was that of a young woman who was thrown from an automobile, and the third was that of a man about thirty-five, who was struck upon the shoulder by a heavy load. In all of his cases there was complete motor and sensory paralysis

of the entire extremity, and the patients came under his observation several months after the occurrence of the injury.

In operating on these cases, Dr. Kammerer said, he had made an incision along the posterior border of the sternocleidomastoid, continuing it along the clavicle in an outward direction, and finally passing over the clavicle into the axilla. The clavicle was divided in its outer half. Although this incision gave a large exposure, in none of his cases was he able to find the central ends of the nerves so that a satisfactory suture could have been applied. Only in the last case was he able to identify the short stumps of the third and fourth cervical nerves, to which he sutured the peripheral ends of the plexus. In one of the cases, after a most painstaking dissection, no nerve-ends were found issuing from the spinal column and no attempt at suture was made.

In the last case a few strands were found coming from the spinal column at one point, but the final suture was at the ends and seemed to hold out little promise of success.

These three operations had been done four and five years ago and up to the present moment very little improvement, if any, had followed in the two cases in which suture had been attempted. The speaker had been impressed by the great difficulty in dissecting out the scar-tissue, when several months had elapsed since the injury, and he thoroughly agreed with Dr. Taylor that an early operation should be done if better results were expected.

Dr. Charles H. Peck said his experience with this condition was limited to a single case, that of a patient who came to him two years ago last October, and whom—if he remembered rightly—he showed at a meeting of this Society shortly afterward. The patient was a professional bicycle rider who sustained a fracture of the clavicle, and when Dr. Peck saw him, five weeks later, there were evidences of complete paralysis of the fifth, sixth and seventh cervical nerves. Upon exposure, these nerves were found to be completely torn across just outside the intervertebral foramina, and after dissecting out the cicatricial tissue he was able to do a fair approximation of the fifth and the sixth nerves, but not of the seventh, which he finally succeeded in implanting into the eighth. For several months after the operation there was no functional improvement. It was now about two and a half years, and when Dr. Peck last saw the patient, perhaps a month ago, he found that the tone and function of the muscles had been re-

gained to a very great extent; he was still unable to abduct his arm, but the atrophy of the deltoid had disappeared and it contracted strongly; the same was true of the extensors of the wrist, though the wrist drop was not entirely overcome. Regeneration of biceps and brachialis was practically complete.

DR. HOWARD LILIENTHAL said Dr. Taylor made no mention of the immediate repair of these injuries, merely stating that the operation should be done at the earliest moment after the effects of the original traumatism had subsided. Personally, the speaker said, he had had no experience with these cases, but he saw no good reason why we should not follow the ordinary surgical rules and operate immediately after the injury, cleaning out the blood clots and doing an immediate repair.

DR. KAMMERER thought a distinction should be made between those cases that were associated with a skeletal injury, such as a fracture of the clavicle, and those that were not.

DR. TAYLOR, in closing, said that in cases like those referred to by Dr. Kammerer, where the roots were apparently torn out of the foramina, the outlook was very bad. While it was desirable to operate early in these cases, Dr. Taylor said he had never seen a case earlier than the eleventh day, and we were more apt to see them much later, as the injury was so frequently unrecognized, and these patients floated from one clinic to another.

THE RIB-FINDER.

DR. THEODORE DUNHAM showed an instrument, which he had devised for the purpose of facilitating the resection of a rib. It steadied the tissues over the rib, arrested hemorrhage while the soft parts were being cut, and guided the knife from the time of the incision of the skin to the severing of the periosteum along the middle of the rib.

The instrument was composed of one solid piece of metal, and he said the description of it would perhaps be most intelligible if it were regarded as being made up by the assembling and soldering together of four pieces. Two strips of flat brass were laid parallel to one another and rotated in opposite directions until two of their edges were about one-eighth of an inch apart, while the other two edges were about three-fourths of an inch apart. The strips were given a slight curve, while their parallelism was maintained. These strips were now joined together at their extremities by two

pieces of flat brass which entered slots cut in the strips. Soldering made the four pieces of metal one.

The principle of the instrument was that when it was pressed firmly upon a rib it would seat itself with considerable rigidity upon the rib, and the slot of the instrument would over-lie the middle of the rib. Hence the knife, cutting in the slot, would find its way directly to the bone of the rib, making one clean cut without shifting of the tissues, very rapidly and without hemorrhage until the instrument was removed, when any vessels could easily be caught. The slight curve in the instrument adapted it sufficiently to the curve of the ribs. The narrower face of the instrument was intended for cases where the ribs were small; the larger face for cases where the ribs were broader. In making a fairly long incision it was well, on account of the cylindrical shape of the chest, to rock the instrument, so that the greatest pressure would be at the point where the knife was cutting.

Dr. Dunham said he devised this instrument over three years ago and had used it in more than twenty cases of rib resection for empyema. It had never failed to guide his knife to a rapid and clean division of all the tissues down to the rib.

Stated Meeting, held at the New York Post-Graduate Hospital, May 14, 1913.

The President, Dr. Charles L. Gibson, in the Chair.

RUPTURE OF THE LIVER IN A CHILD.

Dr. John F. Erdmann showed a boy, six years old, who was admitted to the Gouverneur Hospital with the history that he had been run over by a truck. Examination showed a rapid pulse and marked abdominal tenderness. Within two hours after the receipt of the injury, Dr. Erdmann opened the abdomen through a median incision above the umbilicus, disclosing a rupture through the right lobe of the liver. This was repaired with several stitches and the abdomen then closed without drainage. Recovery was uneventful.

RUPTURE OF THE JEJUNUM IN A CHILD.

Dr. Erdmann presented a boy, six years old, who was admitted to the hospital with the history that while running he

stumbled, and as he fell, he was thrown against a piece of projecting timber. The blow was received directly over the region of the umbilicus. The case was regarded as one of rupture of the ileum or jejunum. Exploration of the abdomen revealed a perforation of the jejunum, twelve inches from its origin, and upon exposing the appendix it was found to be œdematous and was removed. The jejunal opening was closed. The abdomen was drained for 48 hours.

PARTIAL GASTRECTOMY: POSTERIOR GASTRO-ENTEROSTOMY.

DR. ERDMANN presented a man, fifty years old, a druggist, who entered the Post-Graduate Hospital on April 14, 1913, with the history that for the past 25 years he had suffered from indigestion, with nausea and inability to retain certain vegetables. At times the nausea was associated with pain. His symptoms gradually became more aggravated until he was unable to take any solid food without experiencing severe pain in the region of the pit of the stomach, which would be relieved by vomiting.

Operation, April 22: Upon opening the stomach, a tumor was found at the pylorus, with marked infiltration of the pyloric area. A partial gastrectomy and posterior gastro-enterostomy were done. The patient was discharged, at the end of 3 weeks, able to take all kinds of food.

CARCINOMA OF THE PAPILLA OF VATER: CHOLECYSTOSTOMY: POSTERIOR GASTRO-ENTEROSTOMY: CHOLECYSTENTEROSTOMY.

DR. ERDMANN presented a machinist, forty-six years old, who entered the Post-Graduate Hospital on December 30, 1912, complaining of pain and vomiting after meals. His present illness dated back about three months, with pain in the epigastrium and vomiting, coming on from a few minutes to a few hours after taking food. The pain was located in the median line; it was colicky in character and was always relieved by vomiting. No blood had ever been observed in the vomitus, which consisted of previously ingested food, with mucus, with the occasional addition of a large quantity of greenish material. His symptoms gradually increased in severity until the pain would come on immediately after taking food of any character, only to

be relieved by vomiting. The patient had lost 20 pounds in weight during the past three months.

An examination of the blood showed 7000 leucocytes and was otherwise negative, as was also the urinary examination and the Wassermann. An analysis of the gastric contents showed considerable retention, with a total volume of 275 c.c.; free hydrochloric acid, 19; combined, 9; total acidity, 36; no blood. The fluoroscopic examination, made by Dr. L. Kast, showed evidences of marked gastric retention, and an obstruction of some kind, probably a tumor, in the duodenum, the first portion of which was markedly dilated, with the hepatic flexure drawn between the duodenum and the median line. From these findings, Dr. Kast made the diagnosis of stenosis of the mid-portion of the duodenum.

Operation, January 14, 1913: This revealed a marked dilatation of the pylorus and the first portion of the duodenum, with an annular constriction of the duodenum at the ampulla of Vater. The gall-bladder was greatly dilated with fine biliary sand. A cholecystostomy and posterior gastro-enterostomy were done, and the patient left the hospital twenty-one days later, apparently well. Two weeks later he had a discharge of bile from the healed cholecystostomy wound, with the development of jaundice. He was re-admitted to the hospital on April 11, and when the abdominal wound was re-opened it was found that the tumor, which had constricted the jejunum, had become mushroom-like in its growth and about three times its original size. A loop of jejunum was brought out and anastomosed to the gall-bladder—cholecystjejunostomy. The patient left the hospital 4 weeks after the second operation with a gain of 20 pounds.

ACUTE PANCREATITIS: TWO CASES.

DR. ERDMANN presented a man, fifty years old, who after a history of gall-bladder disease dating back three years had a sudden attack of sharp pain, with profound jaundice and some cyanosis and dyspnœa. He was admitted to the hospital, and was operated on by Dr. Erdmann on the third day of his attack. Upon opening the abdomen, he found a hemorrhagic pancreatitis, with fat necrosis. A cholecystectomy and choledochotomy were done. A fistula (*mucus*) persisted for 18 months with spontaneous closure.

Dr. Erdmann's second case of acute pancreatitis was that of a man, thirty-five years old, who gave a history of very sharp abdominal pain, and upon admission to the hospital his temperature was 102°; pulse, 120. Upon opening the abdomen for a supposed appendicitis, free fluid was found in the peritoneal cavity. A median incision was then made higher up, revealing an acute pancreatitis, without any evidence of fat necrosis. Liberal drainage of the pancreas by puncture and a cholecystostomy were performed.

EXCISION OF REMAINS OF WOLFFIAN (?) DUCT.

DR. ERDMANN presented a man, a physician, whose family history was negative, and who gave no history of venereal trouble. In December, 1909, he had an attack of left pleuropneumonia, with effusion, and for six months following this illness he complained of vague pains in the back, with vesical tenesmus. His urine during this period contained pus, and a diplococcus (probably the pneumococcus) was more or less constantly present. The diagnosis of tubercular kidney was made at that time.

On July 7, 1910, the patient developed an acute septic condition, with chills and high temperature. He was seen by Dr. Erdmann, who found a large mass in the left iliac region. The prostate also seemed to be enlarged. A perineal section was done the following day and some pus evacuated. The perineal wound was re-opened twice during the summer and again in October, 1910, when a retention catheter was inserted, permitting free drainage. The tube was left in place for eighteen months, during which period the patient's general condition improved. The discharge from this opening was semipurulent, with a urinous odor, and was supposed to connect with a diverticulum of the bladder. It was treated by curettement and various instillations, but failed to close, and finally, on April 10, 1912, a radical operation was undertaken. The abdomen was opened through a transperitoneal incision, revealing a mass which extended from the prostate up to the diaphragm. It was about seventeen inches in length, gradually developing into a large tumor under the diaphragm, which resembled a cystic kidney. In dissecting it out, which was accomplished with great difficulty, the left ureter was unfortunately injured. Five weeks later the left kidney was removed. The patient still had a small sinus in the perineum which discharged slightly.

Dr. Erdmann said this specimen had been submitted to several pathologists, and various opinions had been given as to its nature. Some regarded it as the remains of the Wolffian duct, while others said they did not know what it was.

SKULL DEFECT, WITH TIBIAL GRAFT.

Dr. Robert T. Morris presented a man twenty-five years of age, who entered the Post-Graduate Hospital on April 4, with a depressed pulsating area at the site of an injury to the left frontal bone. Fracture of the skull had been produced at this point with a beer bottle some months previously, and some bone had been removed at the Bushwick Hospital in Brooklyn.

In order to remedy the skull defect, Dr. Morris had made a tibial transplantation, using a quadrangular segment about 1¼ inches long and 1⅛ inches wide, and fitting it into a corresponding space in the frontal bone. Primary union followed. The patient left the hospital two weeks later. Sixteen days after that, he returned with a transverse fracture of the tibia at the site from which the bone graft had been removed. While rising from a chair, with his left foot slightly flexed and abducted, he put his weight upon it and felt the tibia snap. Dr. Morris said that he had heard of four cases similar to this one very recently, and he believed it very important to give warning of the danger, now that tibial grafts are being used so extensively. The reason for the fracture at this point, where the bone would seem to be sufficiently strong, was due to the mechanical feature of destruction of the reed principle, when a segment of the firm outer layer of the reed had been removed. The patient is now comfortable with a plaster-of-Paris splint, and the radiograph showed the fragments in perfect position.

OSTEOPLASTIC OPERATION ON THE FOOT FOLLOWING INJURY.

Dr. Morris presented a civil engineer, twenty-five years of age, who entered the Post-Graduate Hospital on February 14 with ankylosis of the right ankle-joint. Two years before, the foot had been injured in a street car accident, and the patient had been treated with a plaster cast at the Toronto General Hospital for four months, good repair having been obtained so far as the compound fracture was concerned.

The radiograph taken by Dr. Cole showed that the astragalus had been displaced, presenting its short axis in the line which should be occupied by the long axis. Dr. Gibney had seen the case in consultation and advised removal of the astragalus. When an incision had been made for the purpose, Dr. Morris found that he could not enucleate the astragalus because the entire joint was filled with fibrous and bony exudate. Consequently, he had removed a V-shaped wedge which included not only the astragalus, but parts of adjacent bones, and this allowed of correction of the talipes and the obtaining of a foot upon which the patient had been able to play a game of base ball recently.

CÆCOSIGMOID ANASTOMOSIS.

DR. MORRIS presented a man, twenty-three years of age, who entered the Post-Graduate Hospital on January 16, with a history that 13 years ago he was operated upon for appendicitis with abscess through a right lumbar incision. Details of the case at that time not known. Eighteen months after the first operation, another abscess formed and was operated upon. This wound also closed in about a month. The patient remained well for five years and then had a third attack. At this time his appendix was removed and the wound was closed. Two years later, a fourth attack with abscess led his physicians to believe that the abscess had been a psoas abscess from the start. The last wound remained open for a year, and when it closed, the patient suffered at once, requiring another opening.

When he entered the Post-Graduate Hospital, on January 16, it was supposed that the abscess was connected with carious bone, for the reason that there was no history of escape of gas or bowel contents from the fistula, which was believed to be a sinus. A bismuth picture having been obtained, however, showed that there was indirect connection with the cæcum, intra-abdominal pressure making a sort of valve of the cæcum. The entire fistulous tract was laid open and an attempt made at closing the bowel opening. This failed. Dr. Morris then made a midline incision and found that the cæcum was of the mobile type, lying nearly in contact with the sigmoid. A cæcosigmoidostomy was done. This had relieved the patient from his distress and from his constipation. The site of the old sinus was at the present time filling with granulation.

NEPHRECTOMY FOR HYPERNEPHROMA.

DR. WILLY MEYER presented a woman, fifty-seven years old, who was admitted to the German Hospital on June 24, 1912, with the history that two years ago she had a sudden severe pain in the region of the mid-abdomen, followed by the appearance of blood in the urine, and on the following day she noticed small, stone-like particles in the urine. Since then she had suffered more or less constantly from hæmaturia, the blood usually being clotted and dark red in color. Micturition was usually painless, but was at times accompanied by a steady, non-radiating pain in the right abdomen. She was obliged to pass urine frequently and had an almost constant desire to micturate. A few days ago she had two passages of blood from the urethra within 24 hours, with pain in the right side of the abdomen and in the urethra which lasted about fifteen minutes. The urine passed between the hemorrhages was clear.

The patient complained of shortness of breath, and that her feet occasionally swelled toward evening. There was cardiac palpitation at times, with frequent headaches. The bowels were regular. The appetite was poor. In the left hypochondriac region a firm mass was made out. It was smooth in outline, about four by six inches in size, with its longest diameter extending diagonally downward and inward from the mid-axillary line. It was most prominent just below the costal margin, where it felt tense and smooth. It was freely movable and could be pressed downward and inward so that its lowest pole could be felt one inch to the right and below the umbilicus. It was slightly tender near its lower margin, and moved freely with the movements of respiration. Upon inflating the colon, it was found that the large intestine lay above the mass and pushed it to the left side. A vaginal examination showed nothing abnormal. The cystoscope showed the bladder mucosa normal. The ureters were not catheterized.

Operation, June 29, 1912: A vertical incision was made, about six inches long, beginning an inch and a half from the spinous process on the right side and the kidney exposed. From about the centre of this incision, extending diagonally downward and forward toward the mid-line of the body, a second incision was made so as to fully bring to view a large retroperitoneal mass

which apparently involved the kidney. This mass was stripped from its capsule and removed. During its removal, the peritoneum was opened. This was closed with a continuous plain catgut suture, also the mesocolon of the descending colon, which had been longitudinally incised. The skin wounds were then closed, and the patient made an uneventful recovery, and was discharged on August 15, 1912. To-day there is no sign of recurrence; patient has considerably gained in weight, is in perfect health.

DR. MEYER presented a woman, thirty-five years old, a domestic of Irish birth, who was admitted to the German Hospital on May 15, 1912, with the history that she had always been well until the previous December, when she had an attack of vomiting, with pain in the upper abdomen, which lasted for a few days. The following month she had a similar attack and after this they were of more frequent occurrence and lasted for a week or ten days. The vomiting occurred, usually, in the morning and was accompanied by cough, but no sputum nor blood. Her last attack occurred about a week ago. The vomitus consisted of food she had taken. She was told that she had an ulcer of the stomach. She denied the excessive use of alcohol.

About a week prior to the patient's admission to the hospital she had a dull pain in the left portion of the abdomen, and at the same time she noticed a large mass there. This remained unchanged in size and gave rise to an uncomfortable sensation rather than actual pain, excepting when she lay on the right side. The bowels were constipated; appetite good. The patient thought she had lost much weight recently, and seemed poorly nourished.

Examination of the abdomen showed a firm mass on the left side. The skin covering it was freely movable, as was the mass itself, which on deep inspiration seemed to slip for several inches beneath the abdominal wall in a supero-inferior direction. The dulness of the growth appeared to be continuous with that of the liver. It could be moved slightly from side to side, and was visible, especially laterally and from below, and extended to the left flank. Its outline was smooth and well defined; not nodular. There was no distinct fluctuation. There was slight tenderness upon pressure over the mass posteriorly. When the colon was inflated the mass appeared to be forced to the left; its dulness was not diminished, and the colon seemed to lie inferiorly to the mass. The tumor was oval in shape, with its longest supero-

inferior diameter about five inches long and its lateral diameter about four inches.

Operation, May 25, 1912: An incision was made on the left side extending from the twelfth rib for about five inches through the muscles and the fatty capsule of the kidney. A large cystic mass was found in the depth of the wound. A second incision was then made approximately at right angles to the first, extending across the left side of the abdomen and partly on its anterior surface. The mass was then removed from its capsule and the pedicle ligated with strong silk. The wound was closed, with split-tube drainage. The patient made an uneventful recovery and left the hospital on July 24, 1912. She also is in excellent condition to-day.

IDEAL CHOLECYSTOTOMY (KOENIG'S INCISION).

Dr. Meyer presented a woman, a housewife by occupation, thirty-six years old, who entered the German Hospital on May 20, 1912, who for the past year or so had suffered from attacks of severe, cramp-like pains in the right abdomen. The pain came on suddenly, commencing on the right side of the back and radiating downward and forward on the abdomen. There was no rigidity of the abdomen, and no masses could be felt. There was an area of tenderness extending from the mid-axillary line under the costal border to the right mid-clavicular line on a level with the umbilicus.

The case was regarded as one of cholelithiasis, and on June 10, 1912, Dr. Meyer exposed the gall-bladder through a Koenig incision, beginning about an inch below the costal margin on the right side, extending across the right rectus and then upward toward the ensiform in the midline. Only the inner three-fourths of the right rectus were divided, together with its posterior sheath and the peritoneum. This semilunar incision gave excellent access to the gall-bladder, which was found to be soft and pale, and containing one large stone. The bladder was opened and the calculus extracted. The wound was then closed by a double row of sutures, and the patient made a good recovery.

In this case the appendix was found to be the seat of a subacute suppurative inflammation, and it was removed before doing the cholecystostomy. The abdominal wound was carefully closed by large sutures. At present the patient shows no symptoms of disease and is apparently cured. The abdominal scar is firm.

PYLORIC ADHESIONS AND APPENDICITIS (KOENIG'S INCISION).

DR. MEYER presented a woman, forty-one years old, who was admitted to the German Hospital on April 25, 1912, with the history that for about four months she had suffered from pain in the abdomen. This was intermittent in character, beginning under the xiphoid cartilage and radiating toward the right. She had vomited occasionally, usually after meals. The vomitus had never contained blood.

Examination of the abdomen showed slight rigidity, without distention, most marked under the xiphoid cartilage, and in this area there was marked tenderness on pressure, which extended along the right free border of the ribs and was also present in the region of McBurney's point.

Operation, May 13, 1912: A semilunar (Koenig) incision was made across the upper border of the right rectus and linea alba, and the rectus muscle and sheath divided transversely. The gall-bladder was not distended, but there were rather broad and firm adhesions between the gall-bladder and stomach. These were divided between double ligatures. No sign of duodenal or gastric ulcer.

The appendix, which was directed upward behind the cæcum, was rather long, but neither congested nor swollen. It was attached to the mesentery of the cæcum. The appendix was removed, the wound closed, and the patient made a good recovery. She is well to-day. Dr. Meyer considers Koenig's incision, same as that recently recommended by Perthes, a step forward, inasmuch as both avoid the injury to the nerve branches of the right rectus muscle. A paresis or partial paralysis of the upper portion of the latter cannot set in as it sometimes occurs with the longitudinal division of the muscle, so much in use in gall-bladder surgery.

RESECTION OF THE ABDOMINAL WALL FOR RECURRENT TUMOR IN A HÆMOPHILIAC: PREVENTIVE INJECTION OF HUMAN BLOOD SERUM: RECONSTRUCTION OF ABDOMINAL WALL BY SILVER WIRE FILIGREE.

DR. MEYER presented a man, thirty-six years old, a cigar-maker by occupation, who was admitted to the German Hospital on January 7, 1913, with the history that about six years ago

he noticed a small lump under the skin to the right of the umbilicus. During the first two and a half years this tumor gradually increased in size until it was as large as an infant's head. It was removed, only to recur in the same location about fifteen months later, and a year and a half ago it was again removed. Since then there had been a swelling within the abdominal wall of about the size of an orange, in the region of the gall-bladder transgressing the middle line, and a smaller tumor at the lower end of the operative wound over the bladder region. These growths were absolutely painless and gave rise to no symptoms. There was no loss of weight and the patient otherwise appeared to be in excellent health. Diagnosis: recurrent fibrosarcoma.

First operation, January 21, 1913: Upon exposing the suprapubic tumor it was found to be adherent to the peritoneum; it could be excised without opening the latter. The extensive gap in the abdominal wall was closed with the aid of a silver wire filigree, made in the spot. Cable silver wire was used. On several occasions after the operation, the dressings were found to be saturated with blood. It was then learned that the same had been observed in the two previous operations and the patient was pronounced a hæmophiliac. It took more than ten weeks before the wound had closed by granulation. The wire had to be removed.

Before attacking the tumor above, preparatory hypodermic injections of human blood serum were administered about ten ounces in all, the blood having been derived from a healthy relative of the patient. On April 28 the abdominal wall in the right hypochondriac region was excised in its entire thickness, excepting the skin, and as large as the palm of the hand. On inspection a large infiltrating tumor was found in the liver. Another organ was not affected. It was deemed inadvisable to remove a portion for diagnosis. Now the omentum was spread out and stitched to the borders of the large defect and the gap covered by a filigree of various sizes of cable silver wire. On top of this the skin was closed without drainage. Primary union followed, a secondary hemorrhage did *not* set in. The abdominal wall appears perfectly firm. Pathologically the growths were pronounced rhabdomyomata, clinically they had to be considered fibrosarcoma. It will be interesting to observe the further course, particularly on

account of the tumor of the liver. The case proves again the effectiveness of the injection of blood serum to overcome the dangers of an existing hæmophilia.

ULCER OF THE DUODENUM: PYLORIC EXCLUSION.

DR. MEYER presented a woman, forty-two years old, who had suffered from gastric disturbance for a number of years. Medical treatment has been thoroughly tried without lasting result by Dr. Max Einhorn, who diagnosed duodenal ulcer. On November 13, before the Congress of American Surgeons at the Post-Graduate Hospital, the abdomen was opened and a distinct infiltrating ulceration found. The stomach was divided transversely, Hueltl's wire-stitching instrument being used for suturing and placing a double row of wire staples for occlusion of either end at the same time; then both stumps were inverted by a single running suture of silk. Posterior gastro-enterostomy was then added. Convalescence was uninterrupted, with normal temperature from the beginning. To-day patient states to be materially benefited, though not yet entirely free from trouble.

ECHINOCOCCUS OF THE LIVER.

DR. MEYER presented a woman, twenty-eight years old, an Italian by birth, who was also operated on at the Post-Graduate Hospital. There was a large, bulging mass with smooth surface and evidently deep fluctuation below the right costal arch, passing upward and underneath the same, clearly a cystic tumor (echinococcus) of the liver. The abdomen was opened by a rectus incision. The wall of the cyst in the liver was calcified; there were quite a number of cyst-like irregular spots in the liver. After closure of the abdominal wound up to the liver and careful tamponade, the cyst was tapped and then incised. It contained typical clear echinococcus fluid and a great many daughter cysts of various size, with masses of coagulated material. The wall of the cyst was stitched to the parietal peritoneum and the large cavity amply drained. About twelve weeks after the operation the cyst's wall was discharged in one mass and it now seems that the patient will be cured. She is still at the hospital.

TOTAL ANKYLOSIS OF THE LOWER JAW FOR TWENTY-TWO YEARS: BILATERAL RESECTION OF THE CONDYLOID PROCESSES.

DR. MEYER presented a man, twenty-eight years old, who when he was six years of age fell on his chin. Not long afterward his trouble began. As long as he can remember he was unable to open his mouth. When first seen, patient showed the typical symptoms of micrognathia. Lower jaw much arrested in development, anterior curve of bone at least one inch inward of that of the upper jaw; teeth of inferior maxilla grown forward in oblique direction, as seen in a horse, but their crowns do not meet their opponents; all teeth are present and in good condition; there is a space of about one-sixteenth of an inch between the two rows of incisor teeth. The jaw's articulation with the temporal bone appears to be totally ankylosed on both sides. One is able to palpate a broad bony mass in front of each external auditory meatus. X-rays corroborate this condition. Operation, done eight weeks ago, demonstrated the total absence of a mandibular joint on either side. A large bony mass, one and a half inches wide, thick, eburnated took the place of the condyloid and coronoid processes. A large piece of the bone was resected bilaterally, a flap of fascia or muscle was not turned into the resulting cavity, because the wound, had to be tamponed (with sutures placed, but not tied), on account of rather profuse hemorrhage. Tampons were removed and wounds closed 48 hours later. To-day patient can open his mouth nicely, although the muscles, which have to pull the jaw downward are not developed. The next step is removal of the lower molars with chisel and a prothesis with a set of lower teeth, attached to those present, which will enable the patient to masticate.

WIRING OF AORTIC ANEURISM.

DR. MEYER presented an Italian, fifty-seven years old, who was admitted to the German Hospital on July 26, 1912, with the history that for the past two years he had suffered from pain in the chest, with dyspnœa and a more or less constant cough. He had sciatica sixteen years ago, and a chancre a year later. He was under treatment for syphilis for only two weeks.

Examination of the chest showed an area of cardiac dulness

extending from the first to the fifth interspaces, both to the right and left of the median line, with marked pulsation, which could be seen and felt. The apical impulse was not palpable and the heart sounds were scarcely audible. But there was a loud bruit. A diagnosis of aortic aneurism was made, which the X-ray findings confirmed.

The patient was kept under observation on the medical division for several months, and was treated with mercurials and salvarsan, with very slight improvement in his symptoms. He still complained of pain, and suffered from cough and dyspnœa. On November 17, 1912, Dr. Meyer introduced into the aneurismal sac thirty-two feet of gold-platinum wire, through which an electrolytic current was then passed to hasten the formation of a clot. The technic followed was that described by Dr. William C. Lusk. Following this operation, there was marked and rapid improvement in the patient's symptoms, and he was discharged on January 12, 1913. A stereoradiographic examination made on the day prior to his discharge showed the wire in the aneurismal sac, with no perceptible change in the size of the latter. Having been bedridden before, he can now walk up four flights of stairs. Wassermann test being still four plus, further treatment with salvarsan is indicated.

INTRATHORACIC CARDIOPLASTY FOR INTRACTABLE CARDIOSPASM: SECONDARY THORACOTOMY.

Dr. Meyer presented a man of forty-four, in good general condition, who had long suffered from intractable cardiospasm. He regularly regurgitated about two-thirds of each meal, and asked for operative relief. In May, 1911, bilateral vagolysis and single plication of the œsophageal fourth had been done, with rapid recovery and temporary marked improvement in swallowing. Gradually the former trouble had returned, very likely in part due to the scar formation around the lower portion of œsophagus and the cardia. Patient asked for further operative treatment in spite of possible dangers connected with such work, which were thoroughly explained to him.

On February 13, 1913, Dr. Meyer opened the thorax for the second time and did an intrathoracic cardioplasty. The left eighth and ninth ribs, together with the intercostal tissues, were excised, giving wide access. Then, with the tips of the fingers,

the lung was gradually loosened from the lateral chest wall, and the rather firm adhesions also those to the diaphragm were put on the stretch and cut close to the latter in order to avoid injury to the lung tissue. The region of the œsophagus was now well exposed, but firm scar tissue was met with next to the aorta; this was incised, and the finger gradually worked around the œsophagus. This was very difficult and time-consuming, but was finally successful. The pneumogastric nerves which were firmly adherent to the œsophagus, were again carefully loosened and pushed aside, the aorta loosened, and a cardioplasty made according to the Heinicke-Mikulicz method at the pylorus. The old scar tissue interfered much with this work, as only about one inch of the cardiac portion could be pulled upward. The longitudinal incision of the œsophagus, one inch long, was then stitched in the transverse direction by two rows of sutures and the wound covered by a free fascia transplant from the fascia lata of the left thigh. Recovery was slow, but continuous, patient is still under treatment. Swallowing is much improved.

CANCER OF THE ŒSOPHAGUS: JIANU'S GASTROSTOMY AND INFERIOR ŒSOPHAGOPLASTY.

DR. MEYER presented three patients operated on by him by this method recently. The procedure was carried out with needle and thread throughout (one patient), and also, when cutting out and forming the Jianu tube, with Hueltl's wire stitching instrument (two patients). See article on œsophagoplasty, ANNALS OF SURGERY, September, 1913.

PNEUMOTOMY FOR LOCALIZED BRONCHIECTASIS AND GANGRENE.

DR. MEYER presented a woman, twenty-eight years old, with localized gangrene of the right upper lobe following a severe ether (aspiration) pneumonia after extirpation of an ovarian cyst. When seen there was high fever and very foul smelling expectoration. The disease could be well located by clinical examination and X-rays. Operation, March, 1910, with patient's head in plus pressure cabinet, should differential pressure have become indicated. It was not required during operation. Resection of second and third rib with cartilage, intercostal tissue removed. Lung cavity opened with cautery, finger introduced and a num-

ber of intervening walls broken through bluntly. Pus found; no hemorrhage; drainage. A year after operation the fistula closed. To-day patient is in splendid condition.

THORACOPLASTY AND DELORME'S OPERATION FOR FISTULA FOLLOWING EMPYEMA.

DR. MEYER presented a boy, sixteen years old, who gave a history of pneumonia, with empyema, ten months ago. A resection of one rib was done, which resulted in a persistent fistula. The resulting cavity was repeatedly injected with bismuth, followed by bismuth poisoning and irregular fever.

The patient was seen by Dr. Meyer in December, 1912. After raising a skin-muscle flap, he excised a section of the chest wall involving five ribs. The pulmonary pleura was thin, and was peeled off, and a tamponade inserted. The patient made a good recovery, and was now in perfect health.

THORACOPLASTY FOR CHRONIC EMPYEMA.

DR. MEYER presented a man, twenty-five years old, who gave a history of right-sided pneumonia two years ago. This was followed by an empyema for which he was operated on three times. There was an obstinate fistula near the spine, between the ninth and tenth ribs, and the probe and X-ray revealed a tube-like cavity adjacent to the spinal column and extending up to the second rib.

In March Schede's incision, scapula turned up, and second to fourth ribs inclusive resected in their posterior half. Good convalescence; still under treatment.

The X-ray plates of three last patients were exhibited.

LIGATION OF BRANCHES OF THE RIGHT AND LEFT PULMONARY ARTERY FOR BRONCHIECTASIS.

DR. MEYER showed three cases of bronchiectasis in which he had performed this operation under differential pressure (see ANNALS OF SURGERY, August, 1913, pages 197–200).

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held May 5, 1913.

GEORGE G. ROSS, M.D., in the Chair.

ACUTE GASTRIC DILATATION FOLLOWING OPERATION FOR HERNIA.

DR. JOHN SPEESE presented a man, fifty-six years of age, who was operated upon at the Presbyterian Hospital for an incomplete inguinal hernia by the Bassini method. The patient recovered consciousness readily and experienced but slight nausea from the ether. Thirty-four hours later, after drinking a small quantity of milk, he complained of nausea, which gradually became more severe, and was followed by vomiting two hours later. Temporary relief was experienced, and no alarm was felt as the temperature, pulse and leucocytic count were normal and the abdominal muscles relaxed. The vomiting recurred, the fluid was dark in color, odorless and was ejected in small amounts without effort every few minutes. The patient then developed considerable abdominal pain, and on examining the abdomen at this time, the stomach was found greatly dilated, extending to the umbilicus, and partially filled with fluid, as determined by a succussion splash. A stomach tube was passed and several quarts of dark fluid withdrawn, and lavage performed. An abdominal binder was applied and the patient turned on his abdomen, a position he could assume only for short periods.

He was entirely relieved of the pain and vomiting for six hours, when the latter recurred in a less severe form. The same treatment was carried out and permanently relieved the condition. Examination of the stomach twelve hours after the vomiting began, disclosed a normal state of affairs, the dilatation having perfectly subsided. The patient was given salt solution by rectum to relieve his thirst, and small quantities of water by

mouth were allowed twelve hours later without causing any disturbance.

Dr. Speese remarked that acute dilatation of the stomach may follow any variety of operation, although it appears to be relatively uncommon as a post-operative complication of hernia. Lyle (*N. Y. Med. Jour.*, 1911, xciv, 932) observed a case following the radical cure of a hernia, the operation was performed under local anæsthesia, and a large amount of omentum was resected. The dilatation began one hour after the operation, and in all probability was caused by the removal of the large amount of omentum which profoundly altered the circulation and possibly the nervous mechanism of the stomach, thus causing a temporary muscular paralysis.

The finding, at post-mortem, of constriction of the duodenum by the superior mesenteric artery at the point where it crosses the intestine, has naturally caused this factor to be regarded as of much importance in the etiology of the affection. That the constriction can be caused by an abnormally long mesentery or by ptosis seems unlikely, and is denied by Mathieu (*Arch. d. Mal. d l' App. Dig.*, 1911, v, 409) who regards the gastric dilatation as the primary factor. Distention of the stomach must take place in a downward direction, the intestines are compressed, the superior mesenteric artery is put on a stretch and the duodenum is thus constricted. The primary dilatation is caused by aërophagia, which is the result of the constant swallowing which follows the nausea and pharyngeal irritation induced by ether. This view seems feasible in the case reported as the patient complained of annoying thirst soon after his recovery from the ether and the constant swallowing must have been accompanied by the passage of a considerable quantity of air into the stomach. The dryness and irritation of the pharyngeal mucosa were moreover increased by a chronic nasal obstruction which made mouth breathing a necessity.

Dr. Edward B. Hodge said that recently, in the case of a woman, fifty-seven years of age, who developed pneumonia one week after operation for appendicitis, temperature was normal for two days, at which time she developed acute dilatation of the stomach; this was relieved after several lavages, but the patient finally succumbed to acute nephritis.

Dr. George G. Ross reported a case of dilatation of the

stomach which occurred about the seventh day after an operation in an otherwise healthy young woman who had pus tubes. She had done very well until the night of the second day when she drank the contents of an ice-bag (about one quart). The next morning she had acute dilatation from which she promptly died in spite of all treatment; the water from the ice-bag being the supposed cause.

RETROPERITONEAL ABSCESS.

DR. SPEESE reported the history of a child, eight years of age, who was admitted to Dr. Jopson's service at the Presbyterian Hospital, complaining of pain in the right wrist and left thigh. One week before he had been struck over the left hip, and in several hours the leg became stiff. This increased to such an extent that in three days the boy could not walk, and the thigh became very tender on pressure. The wrist also began to pain considerably and was slightly swollen.

September 5, 1912, four days after the accident, when admitted he complained of abdominal distention, pain and swelling over the lower end of the radius. The region about the hip was very tender, there was slight swelling on the outer side of the femoral vessels, and pressure over the trochanter caused pain. The temperature was 103°, W. B. C. 15,000. Exploration over the trochanter by Dr. Speese revealed normal bone and no evidence of pus. The lower end of the radius was exposed and free pus was found under the periosteum which was raised, the cortex of the radius was chiselled and several drops of pus found in the medullary cavity.

September 7, 1912, the pain in the hip region continued, and the abdomen was markedly distended, tender, but not rigid. W. B. C. 21,000.

September 9, 1912, an area of fluctuation was detected in the left groin, below Poupart's ligament and to the inner side of the femoral vessels. A large amount of pus containing blood clot was evacuated, and on exploring the abscess cavity it was found to extend behind the peritoneum for a distance of four or five inches. The abdominal distention disappeared after evacuation of the abscess.

The cavity was drained, and closed slowly as the convalescence was prolonged by the formation of several pyæmic ab-

scesses. The bacteriological examination of the pus showed staphylococcus aureus.

Instances of retroperitoneal abscess of this type are uncommon, and may cause considerable difficulty in diagnosis because of the symptoms suggesting an acute inflammation of the abdominal viscera. The origin of the abscess is not easy to explain, it seems rational to suppose that the primary process consisted in the formation of a hæmatoma, the result of the injury sustained. Subsequent infection occurred by bacteria derived either from the intestine or from the blood stream and abscess formation resulted. The same sequence has been observed in rupture of the liver or kidney, followed by hemorrhage into the retroperitoneal tissues.

Diffuse inflammation of the retroperitoneal tissues with pus formation may follow suppurative infections of the appendix, gall-bladder or pancreas. Sprengel (*Arch. Klin. Chir.*, 1912, c, 382) in a recent contribution has thoroughly reviewed the subject, and believes that the general peritoneal cavity in some instances may be uninvolved after appendicitis, for example, while a diffuse suppurative process may attack the retroperitoneal space. As a general rule the peritoneum acts as a barrier and prevents rupture of the pus into the abdominal cavity, but œdema of the mesentery and intestines, and a serous or blood-tinged effusion may result from the infection, and prove misleading when the abdomen is opened.

Sprengel refers to a case which resembles the one reported in many respects. The patient, a woman sixty years of age, sustained a fracture of the neck of the femur, and ten days later was seized with an attack of pain, vomiting and abdominal distention. The patient collapsed and death resulted on the eleventh day. The autopsy disclosed a suppurative para-proctitis which was regarded as the primary infection, and from this a fatal peritonitis arose. The rectal mucosa did not show any trace of injury from which the infection might have started.

The origin and formation of many of these infections is not clear. In children the diagnosis is difficult because of the possibility of an acute osteomyelitis of the femur, and because of the abdominal symptoms produced by pressure of the retroperitoneal effusion. That the disease is not so uncommon may be judged from the occurrence of this case, a second one a short time

afterward in Dr. Rodman's service, and several of similar nature in Dr. Wharton's wards at the Children's Hospital.

Dr. J. Stewart Rodman recalled the particulars of a case which occurred at the Presbyterian Hospital, in the service of Dr. W. L. Rodman. The patient was a boy of ten who had been run over by a wagon three weeks previous to his admission to the hospital, thus giving a history of trauma more or less remote. The diagnosis was not altogether clear at first, as tenderness and fixation of the left hip suggested an acute tubercular arthritis. Later on, however, an easily palpable tumor appeared above Poupart's ligament on the left side which was quite tender to touch and accompanied by a septic temperature. The diagnosis of retroperitoneal abscess was now quite clear. This was opened extraperitoneally and the boy afterward made a rapid recovery.

PERFORATION OF ILEUM BY A FOREIGN BODY FOLLOWED BY SYMPTOMS SIMULATING APPENDICITIS.

Dr. Speese recited the history of a man, aged fifty-three, who was admitted to Dr. Jopson's service at the Presbyterian Hospital with the following history: Two days previously he experienced a sudden and severe pain in the right iliac region, this was accompanied by nausea and vomiting. The pain which continued until his admission to the hospital, gradually became more severe, the nausea persisted but the vomiting ceased; the bowels had not moved for two days. The leucocytic count was 24,500, pulse 92, temperature 99.4°. The abdomen was slightly distended, and on palpation the right rectus muscle was rigid, and pronounced tenderness was present over McBurney's point.

A diagnosis of acute appendicitis was made and the operation which was at once performed by Dr. Speese revealed many recent adhesions about the cæcum, a small amount of turbid fluid and fibrin, but a normal appendix. Believing that an inflamed Meckel's diverticulum might have caused the condition, the ileum was drawn out of the wound and examined. About four inches from the ileo-cæcal junction a foreign body was felt in the lumen of the bowel, one end being firmly embedded in the intestinal wall almost penetrating the serous coat. The body was extracted and was found to consist of a flat piece of bone, 4 x 1 cm., resembling a sequestrum, one end was splintered and as sharp as

a needle. The intestinal wound was closed, examination of the surrounding coils of intestine did not reveal any evidence of perforation. The local peritonitis present was regarded as the result of a puncture of the intestine by the foreign body, the opening being small was soon closed by plastic lymph making its site difficult to discover. The abdomen was drained, convalescence was uninterrupted.

The patient when questioned was unable to remember that he had swallowed a piece of bone, but as he used alcohol to excess, it seemed likely that the accident occurred during one of his frequent debauches, from one of which he was recovering at the time of his admission to the hospital.

Dr. George G. Ross reported a case seen by him which was diagnosed as acute appendicitis; there was tenderness rather higher up than usual. At operation he found the appendix inflamed, but also noticed that on the outer wall of the cæcum there was a great deal more inflammatory lymph than on the inner. In pulling up the cæcum a tooth pick floated up into the wound and was removed. It seemed as if the tooth pick had gone through the ileocæcal valve and had pinned itself on the opposite wall of the cæcum and had ulcerated through.

Dr. Edward B. Hodge said that he saw a patient last summer which resembled Dr. Speese's case very closely: A boy of four years came to the Children's Hospital. It was thought that he had appendicitis; he had the usual symptoms and had had two attacks previously of colicky pain which had been diagnosed as appendicitis by the family physician. Operation revealed some adhesions in the right iliac fossa and some free dirty fluid; no pus. Appendix looked all right. Further search detected a stricture of the ileum about one foot from the ileocæcal valve and a perforation above through which a piece of pickle was protruding. He did not think the pickle made the puncture but the boy had perforation and a very tight stricture. A resection was done and the patient eventually got well.

Dr. Morris Booth Miller raised the question of perforation from foreign bodies. This matter has never been definitely worked out, *i.e.*, why certain objects cause perforation and others do not. All are familiar with the fact that children often have passed through their intestinal tract extraordinary substances, such as coins, pins, buttons and various materials of similar

type. The great majority of these pass through without disturbance, but occasionally serious trauma is inflicted.

Twice he had seen perforation caused by a piece of bone. Several years ago he operated upon a woman who had all the symptoms of acute appendicitis. When opened it was found that she had a perforation of the appendiceal tip due to a piece of chicken bone, which was hardly larger than one-half the size of an ordinary pin. Again, about a year ago he had an experience with a woman, age fifty-five, who had previously undergone a hysterectomy. Following this she had had an incisional hernia which was characterized by adhesions. She was suddenly taken ill with pain, local tenderness in the hernial sac and vomiting. At operation an irreducible hernia was found but not obstruction. Within the sac a piece of chicken bone over an inch long had perforated the gut with some local contamination. It was hoped she would get well, but as she was diabetic she died from coma in two or three days. There was no generalized peritonitis.

(1) PERFORATED MECKEL'S DIVERTICULUM, (2) TWO INDEPENDENT SACS IN AN INGUINAL HERNIA, (3) REMOVAL OF PARAFFINE FROM INGUINAL CANAL IN CASE OF INGUINAL HERNIA.

Dr. A. Bruce Gill reported the following cases from the service of Dr. Hodge at the Presbyterian Hospital:

Case I.—A school-boy, aged thirteen years, admitted to the ward on the evening of March 4, 1913. For a week previous he had been having crampy pains about the umbilicus that occurred for the most part during the afternoon while the patient was in school. On the day of his admission about two o'clock in the afternoon while in school, he was seized with a sudden severe pain about the umbilicus and in the lower right part of the abdomen. He vomited repeatedly and was carried home from school.

On examination at ten o'clock P.M. there was present general abdominal rigidity which was most marked in the lower right quadrant. Pain and tenderness were chiefly in the same quadrant. The patient lay on his left side with the knees drawn up. On preparing the abdomen for operation a small red papule at the umbilicus bled slightly on being scrubbed.

The mother stated later that he had bled from the umbilicus in infancy, and the patient himself had observed a red spot at the umbilicus that would bleed on irritation.

Operation was performed at 10.25 P.M. The abdomen was filled with bloody serum. The appendix was long and kinked, but not diseased. A Meckel's diverticulum was found coming from the ileum about two inches from the ileo-cæcal junction. It was about two inches long and as large as the middle finger. A cord three inches long extended from the end of the diverticulum to the umbilicus. The diverticulum was highly congested and was thickened. Near its base was an annular thickening and constriction. On the distal edge of the dense ring was a small perforation filled with a blood clot.

With the exception of enlarged glands in the transverse mesocolon there was no other evidence of abdominal disease.

The cord attached to the diverticulum was ligated and divided near the umbilicus. The diverticulum was excised and its stump was inverted by a purse-string suture reinforced by Lembert's sutures. The appendix was removed. The abdomen was freely flushed with hot salt solution and a drain was placed in the pelvis.

Recovery was uninterrupted and the patient was discharged on March 21, 1913.

CASE II.—Man, aged fifty-five years. Four years ago he suddenly developed a right inguinal hernia. He was stacking soap-boxes weighing 100 pounds each. While he had the seventh box above his head and was about to place it upon the pile, his right foot trod upon a potato and he slipped suddenly backward. The patient immediately felt a sharp nauseating pain in his right groin, and shortly afterward he noticed a soft swelling in the same region. The hernia has slowly increased in size to the present time. He has latterly worn a truss that did not restrain the hernia but did cause considerable pain. The hernia was reducible.

At operation a hernial opening large enough to admit the forefinger was found internal to the cord and one inch above the external ring. Protruding about two inches through the opening was a pouch of transversalis fascia which contained preperitoneal fat and a thin empty peritoneal sac. The sac was drawn down, ligated, and excised, and its stump was transposed upward

and inward and fastened behind the rectus muscle. Upon examination of the cord a second hernial sac was found coming out of the internal ring. It was freed from adherent veins, opened, and found to be empty. The sac was excised and the stump disappeared into the abdomen. The operation was completed according to the Bassini method, but with the addition of one suture that fastened the edge of the rectus fascia to Poupart's ligament near the pubic spine, and a second suture external to the internal ring.

Recovery was uneventful. The patient was seen recently, which is more than a year since the operation. There has been no recurrence of the hernia, although he returned to his former work and has been doing heavy lifting.

CASE III.—Man, aged forty-eight years. He developed a right inguinal hernia seven years ago. Four years ago paraffine was injected at the side of the hernia by some person unknown. For eight months following this the hernia seemed cured, but at the end of that time it recurred and gradually increased in size. Several masses of paraffine could be felt beneath the skin and within the inguinal canal.

At operation one mass of paraffine was found imbedded in the aponeurosis of the external oblique in front of the canal, another lay beneath the skin above the canal, several pieces, including the largest, were within the canal. The vas was firmly adherent to three separate masses of paraffine and was dissected free with difficulty. The aponeurosis in front of the canal was dense and thick, and structures were obscured by the fibrous tissue about the masses of paraffine. The canal was exposed by splitting the external oblique above the canal and not in front of it and dissecting the lower flap downward. The largest piece of paraffine was near the internal ring, and its fibrous capsule was continuous with a mass of dense tissue that appeared to be an old obliterated sac. All the pieces of paraffine were removed.

A thin, wide-mouthed, empty sac was found posterior and internal to the cord and to the old obliterated sac. It was excised and its stump was transplanted upward and inward and fixed behind the rectus. The conjoined tendon and the edge of the rectus were sutured to Poupart's ligament in front of the cord. The upper flap of the aponeurosis of the external oblique

was also sutured to Poupart's ligament, and the lower flap overlapped it and was sutured above.

Dr. Astley P. C. Ashhurst said that Dr. Gill's case of two sacs in an inguinal hernia reminded him of a similar sac found this winter while operating on a cadaver in the University. There were two sacs in the canal and extending down beyond the external ring; each had a separate opening into the peritoneal cavity at the internal ring. They were excised and sent to Dr. C. Y. White at the Episcopal Hospital for examination. He reported that both sacs were lined with endothelium apparently indentical. The existence of adventitious bursæ which are not very rare in the wall of a hernial sac is easily explained, but he knew of no satisfactory explanation for two distinct sacs, unless both are congenital.

As regards Meckel's diverticulum, he had seen three cases. The first case was reported to the Academy some years ago. There was an internal hernia through a rent in the mesentery of the ileum. The patient was a child, aged twelve, and, as he had learned that if in children from thirteen to fifteen years of age, the umbilicus appears abnormal, one should suspect the existence of a Meckel's diverticulum, the opinion was hazarded before operation that this might be the origin of the obstruction.

Only a month later he saw a man of forty-six years with symptoms of intestinal obstruction. He also had an abnormal umbilicus; four spots could be seen where the fetal structures had come through. In this case the diverticulum was found adherent to the umbilicus on the inside and twisted on itself. Unfortunately, the man died, in spite of relief of the obstruction.

Another case of Meckel's diverticulum he saw in a patient with typhoid perforation. The perforation occurred in the ileum and in looking for more perforations he found a slightly inflamed but non-adherent diverticulum higher up. This patient, who was eighteen years of age, had an abnormal umbilicus.

Dr. Addinell Hewson said that recently, in his service at the hospital, a case came in with symptoms suggesting acute obstruction. Operation was performed and it was found that a Meckel's diverticulum was present and located about 2 feet from the ileocæcal valve, was twisted around the intestine and caused complete obstruction. This case was not in a young person, but in a man of mature age who made an uneventful recovery.

SUTURE OF THE HEART.

Dr. Arthur E. Billings reported the case of a man, thirty-one years old, who was brought to the Pennsylvania Hospital, at 2.55 A.M. on May 7, 1911, and was admitted to the service of Dr. Hutchinson, to whom the reporter was greatly indebted for the privilege of operating upon and reporting this case.

The patient's previous history was negative except for marked alcoholism for the last two years. Present condition: While walking through the east side of Franklin Square he was attacked by a man who stabbed him and fled. He was found by a policeman lying in an alley between Fifth and Sixth and between Race and Vine Streets, from where he was brought to the Pennsylvania Hospital by the patrol wagon. He was unconscious at the time of his admission, presenting the picture of extreme shock with hemorrhage. Temperature was 95°, breathing labored and sighing in character, radial pulse was imperceptible, and skin was clammy and cold. On examination of his thorax, there was a wound about 2 cm. in length in the midclavicular line of the left fifth interspace which was bleeding quite freely with respiratory movements. Percussion and auscultation revealed signs of a marked hæmopneumothorax. The heart sounds were irregular and distant, rapid, and at times almost inaudible.

Operation.—Local preparation consisted of shaving and the application of tincture of iodine to the field of operation. A semilunar incision was made over the left fourth and fifth ribs with the convexity toward the sternum. The fourth and fifth ribs were then severed near the costal border and turned outward about 5 cm. away from the sternal border forming a trap door. The left pleural cavity was filled with blood and the pericardium showed a wound about 1.5 cm. in length and was distended with blood. This opening was increased in length exposing the heart which revealed a wound in the left ventricle between 2 and 3 cm. in length on the external surface and slightly triangular in character, which was bleeding profusely with each systole, and was partially controlled by digital pressure during suturing.

This was closed with five interrupted sutures of No. 1 iodized catgut. The pericardium was closed with a continuous No. 1

iodized catgut suture, without drainage. In the lower lobe of the left lung on its anterior surface, there was a ragged wound about 4 cm. in length which continued to bleed slowly and persistently. The sixth rib was then resected in the left midaxillary line and a small gauze pack was introduced to control bleeding from the lung. The trap door was then closed, the ribs being sutured in place with No. 5 iodized catgut and the skin closed with interrupted silkworm gut sutures without drainage. During the first part of the operation, an anæsthetic was not necessary, ether being used during the latter part of it. During the operation the patient received twenty-four ounces of normal salt solution, intravenously, and strychnine sulph., grains 1/20 hypodermically. After the operation the reaction was fairly prompt and surprisingly good. Pulse one hour after operation was 88 and temperature 96.2°.

During the following twelve hours, temperature reached 102.2°, soon dropping to normal with pulse ranging from 88 to 120, and the patient rational. Thirty-six hours after operation, patient's temperature began to go up, reaching 101.1°, pulse 120 to 140, with much respiratory distress and increasing cough with gradual circulatory failure, death resulting about forty-eight hours after operation. Cardiac compression is suggested in this case because of the marked increase in bleeding after opening the pericardium and improvement in patient's condition at this time.

Autopsy revealed extensive pleurisy and complete solidification of the already collapsed left lung with slight pericarditis about the line of incision and wound.

SPLENIC ANÆMIA WITH SPECIAL REFERENCE TO ETIOLOGY AND SURGICAL TREATMENT.

Dr. J. Stewart Rodman and Dr. De Forest Willard read a paper with the above title for which see page 601.

Dr. Astley P. C. Ashhurst said that the incision in the abdominal wall described by Dr. Willard is very similar to that on the right side which has been employed for many years by Czerny for operations on the gall-bladder and bile-ducts. It has now been adopted by Kocher as his "normal incision" for difficult cases. The extension of the incision outward beyond the

semilunar line corresponds to the incision of Kausch and certainly presents many advantages. He had one occasion himself, four years ago, to explore the cardiac orifice of the stomach and the spleen in a case of gunshot wound. The injury involved both the thorax and obdomen. He made first an incision in the line of the eighth left intercostal space, splitting the abdominal wall in a direction parallel to the nerves. Then the diaphragm was incised sufficiently to expose freely, after retraction of the eighth rib upward and the ninth rib downward, the region above the fundus of the stomach, including the spleen, the left lobe of the liver and the pancreas. Later the lung was exposed. He secured ample exposure by this incision, the abdominal portion of which corresponds to Kausch's, and to the horizontal limb of the incision advocated by Dr. Rodman and Dr. Willard; but unfortunately the patient did not recover.

Dr. George P. Müller reported the following case which he believed to be one of splenic anæmia. The history is as follows: A man, aged thirty, was awakened on the morning of August 26, 1912, by a feeling of nausea without pain. He then vomited a pint of blood and some hours later vomited again a lesser amount. Between the two vomitings he was treated by rest, ice, morphine and calcium lactate. He was sent to the University Hospital by his physician, Dr. Janvier, at about 7 P.M. The patient was a healthy baby until about two years of age, when he had some vague stomach or bowel trouble, accompanied by considerable pain and diarrhœa. This lasted for 3 or 4 weeks and he then recovered quite completely. During boyhood and up to the age of 18 years of age he was apparently well, although always of slim build and having a very white skin. Shortly after this time he had an attack of severe abdominal cramps with profuse diarrhœa after eating freely of oysters, ice cream and peaches. A few days later he had a similar attack and from this time on he has never been entirely well or free from pain and abdominal discomfort. The slightest indiscretion in diet brings on an acute attack of indigestion with abdominal pain and diarrhœa. About a year ago he had a severe attack of abdominal pain and diarrhœa associated with bladder trouble, jaundice, high fever and chills. He was in bed a week or ten days and became reduced in weight and strength. Has had no attack since then but has frequently had sick headaches occasionally associated with vom-

iting and also with pain in lower abdomen and with diarrhœa. After the attack 4 or 5 years ago he had a small hemorrhage from the bowel, but the diagnosis at that time was never definitely made, the condition being counted as a chronic enteritis. Patient is well built, rather fat, active mentally, and occupying a good clerical position. Upon examination shortly after admission the abdomen was flat without rigidity, masses or tenderness. The liver was not enlarged but the spleen seemed slightly so and was palpable one inch below the costal margin. Blood count made at the time revealed: Hæmoglobin, 67 per cent.; red blood corpuscles, 3,730,000, and a leucocytosis of 12,700, of which 81 per cent. were polynuclear. After his admission to the hospital he continued the line of treatment which Dr. Janvier had begun and in addition gave 20 c.c. of horse serum. At 10 P.M. he vomited 16 oz. of blood and, accordingly, it was thought that his stomach should be explored. Incision in right rectus close to the median line and extending from the ensiform to the umbilicus. Upon opening the abdomen the pale intestines and stomach presented nothing noteworthy and upon exposing and drawing the stomach into the wound, no evidence of ulcer could be detected, there being no points of thickening, scars, adhesions, no milk-white patches. The lymph nodes in the greater and lesser curvature were not enlarged. The liver was normal in appearance with thin, sharp edges. The gall-bladder was slightly distended but not abnormal. The spleen was large, measuring about 8 by 5 inches in size, quite firm to the touch and smooth. It was closely approximated to the fundus of the stomach. A small vertical incision was made in the stomach and considerable blood, both fluid and clots, evacuated. A small proctoscope was introduced and the stomach searched from one end to the other for ulcers, erosions or other evidence to show the origin of the hemorrhage. Absolutely nothing was found. In places the mucous membrane appeared congested but nowhere was there evidence of active bleeding. The wound in the stomach was closed with catgut and linen and the abdominal one with catgut and silkworm gut. Patient stood the operation fairly well, but was given 750 c.c. of normal saline solution intravenously at the close of operation.

Patient recovered fairly well from operation without much shock. Temperature gradually declined and reached normal on

the sixth day after operation. Thirty-six hours after operation a blood count revealed hæmoglobin, 40 per cent., and red blood corpuscles, 2,910,000. The fat in the wound showed signs of infection and four or five of the stitches were removed and several ounces of pus evacuated, after which the condition of the wound remained uneventful. At the end of the first week the patient began to pass considerable dark, foul-smelling material from the bowels, the passage of which was controlled by the administration of opium and resorcin. On September 3, seven days after operation, the blood count revealed a hæmoglobin of 24 and red blood corpuscles of 4,470,000. It was evident that the black material coming from the bowel was due to intestinal bleeding and was not a residual of the stomach hemorrhage. More horse serum and certain other drugs were given, after a consultation with Drs. Stengel and Klaer, but made no impression on the patient who became delirious and died on September 9, thirteen days after the operation. No autopsy was allowed but the reporter had always believed this patient was suffering from splenic anæmia, caused by some intestinal toxæmia.

He was especially anxious to report this case because of the error in diagnosis which was made, that it was a case of hæmatemesis from gastric ulcer, based on the history of gastric distress followed by the vomiting of blood. At the time of operation a full history was not obtained but the diagnosis seemed clearly evident, especially in view of the fact that the the patient was practically a total abstainer from alcohol and there was no evidence of syphilis or other disease of the liver. It was the intention to perform a splenectomy when the patient's condition permitted and the family were so informed at the close of operation, but the occasion never arose.

105 CASES OF STRANGULATED HERNIA.

Dr. Emory G. Alexander read a paper with the above title, for which see page 639.

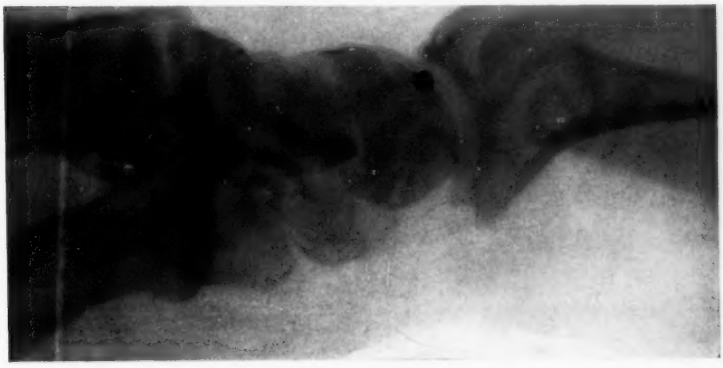
FRACTURE OF CARPAL SCAPHOID AND CUNEIFORM WITH LUXATION OF SEMILUNAR; BLOODLESS REDUCTION; FUNCTIONAL RECOVERY.

Dr. P. G. Skillern, Jr., reported the history of a man, aged twenty-seven, who fell upon his hyperextended left hand. Ex-

FIG. 1.

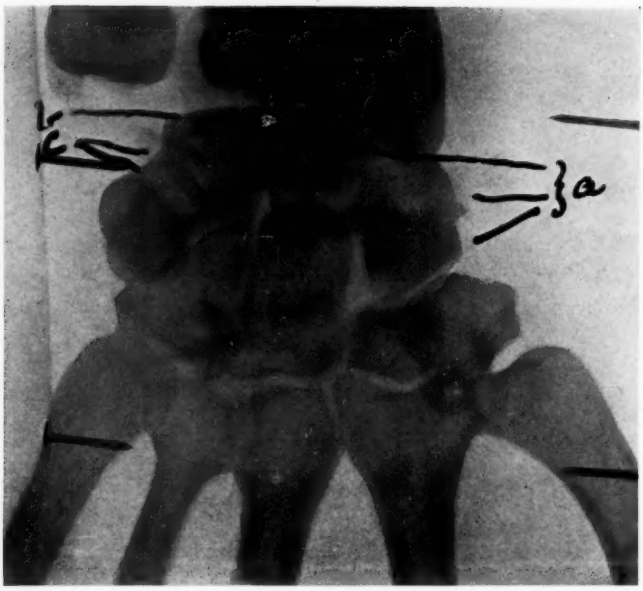
Lateral view before reduction. Note displacement of semilunar anteriorly beneath os magnum; also, shortening of carpus by approximation of metacarpus to radius and ulna.

FIG. 2.



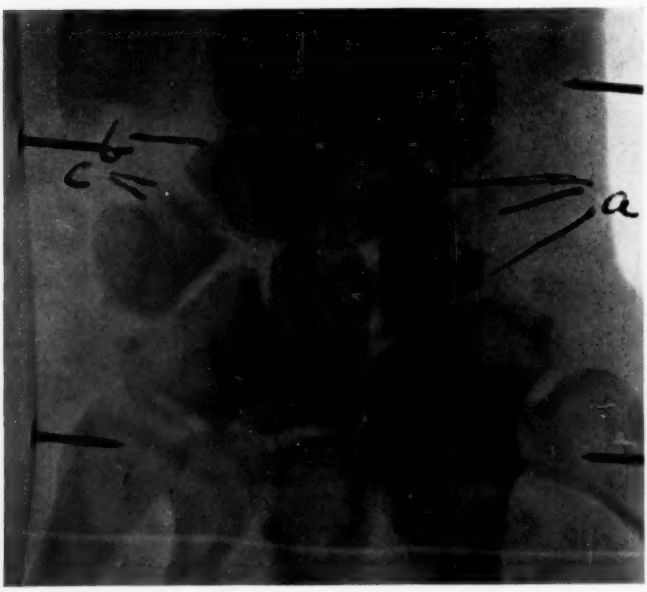
Lateral view after reduction. Note restoration of scaphoid to its normal position with consequent lengthening of carpus.

FIG. 3.



Anteroposterior view before reduction. Note *a*, tripartite fragmentation of scaphoid; *b*, displacement of semilunar; and *c*, fracture of cuneiform.

FIG. 4.



Anteroposterior view after reduction. Note *a*, improvement in position of scaphoid fragments; *b*, restoration of semilunar, and *c*, of fragment of cuneiform.

amination shows swelling around wrist-joint with tenderness in snuff-box and in front of carpus, and also a bony prominence in wrist beneath flexor tendons with shortening from tip of radial styloid to base of first metacarpal. Diagnosis of fracture of scaphoid with luxation of semilunar. Skiagram (Fig. 3) shows separation and displacement of scaphoid tuberosity between tip of radial styloid and trapezium; luxation of semilunar, and fracture of cuneiform. Lateral view (Fig. 1) shows displacement of semilunar into palm with rotation about its transverse axis, so that its concavity faces dorsally, and also a hollow on dorsum between posterior articular edge of radius and os magnum. The patient was immediately anæsthetized with nitrous oxid and manual reduction effected by the method described by Codman and Chase (ANNALS OF SURGERY, 1905, xli, 321, 863). Dressed on Bond splint. Skiagram (Fig. 2) now showed complete reduction of semilunar and (Fig. 4) improvement in position of fragments of scaphoid and cuneiform. After reduction the patient complained no longer of pain. Immobilization was maintained four weeks *without massage and without passive motion.* It must be remembered that this bone is but feebly capable of osteogenesis and is constantly bathed by the synovial fluid, the amount of which would only be increased by massage and passive motion, thus adding fuel to the fire. There being union at the end of four weeks, careful massage and passive motion rapidly restored complete function to the wrist-joint.

A similar case has been described by Corner (*Trans. Clin. Soc.*, London, 1905, xxxviii, p. 224) but the semilunar was fractured, in addition to being luxated, and the cuneiform showed fracture of the portion nearest the radius which damage, as Corner states, was obviously done by the lower end of the radius being forcibly driven on to the carpus. This was shown by close proximity of ulna to cuneiform. This injury was of eighteen month's duration, and had not been reduced. The patient complained that his hand was weak and occasionally painful, and that it had lost some of its power of movement.

The results of neglect or of improper management of this injury is further illustrated by an old case of undiagnosed and therefore unreduced fracture of scaphoid with luxation of semilunar recently described by the author (*Jour. A. M. A.*, 1913, lx, p. 1536). This patient had injured his right wrist seven

months previously in a street accident, and had been treated in another hospital for two weeks as a "bad sprain," skiagram taken at the time being declared negative. Since then the wrist was crippled, flexion and extension being very limited, and patient had pain in the joint on the slightest motion. Owing to the long lapse of time (seven months) since the injury, but one method of treatment was indicated, removal of the semilunar with both fragments of scaphoid. This was done, with relief of pain and increase of motion.

Fracture of the scaphoid with or without luxation of the semilunar is not a rare injury, and readily lends itself to clinical diagnosis by localized "wincing" tenderness in the snuff-box with, in case the semilunar be luxated, a distinct bony prominence in front of the carpus beneath the flexor tendons. This injury should be suspected with the same facility with which Colles' fracture is suspected and the same careful anatomical reduction should be made in order to avoid crippling of the wrist of a wage-earner and subsequent liability for damages which in such an instance seems glaringly justifiable.

CORRESPONDENCE.

LATER HISTORY OF CASE IN WHICH TEN FEET EIGHT INCHES OF GUT WERE REMOVED.

EDITOR ANNALS OF SURGERY:

IN the November issue of the ANNALS OF SURGERY, 1911, there appeared the history of a case which had been curetted by another physician for a macerated fœtus; the uterus was perforated and the patient's gut torn from the mesentery necessitating the removal of ten feet eight inches of the ileum. This was July 10, 1911. In December of the same year she developed a peritonitis of obscure origin vaguely pointing to right tubo-ovarian inflammation with possible appendiceal involvement. She was treated expectantly for si days when an abscess pointed in the cul-de-sac. At this time she was exceedingly septic, having chills, sweats, typical "pump-handle" temperature (maximum 104.5° F.), a thready, intermittent pulse, 120–160. Under nitrous oxid her uterus was curetted and several pieces of fetal bone found; very fetid odor. The pelvic mass was drained through the vagina; she was placed upon Murphy treatment. Drainage was good for five days, though the pulse never dropped under 120°, when it was noticed that the abdominal scar was bulging. This was incised and a large amount of pus evacuated. Her symptoms gradually subsided and she was discharged in three weeks.

Patient remained well and gained several pounds in weight, but unfortunately contracted a double pneumonia in April, 1912, in which resolution was delayed until the 28th day, leading us to suspect a tuberculosis. Under forced feeding she regained the lost ground.

In May, 1913, she began having vague pains in the abdomen (especially on the right side) which progressively grew more severe. Gastric disturbances made their appearance; she ran a rapid pulse with slight elevation of temperature; had a profuse vaginal discharge. After absolute rest, use of ice-caps, restricted diet (the process apparently not being controlled), a supravaginal hysterectomy and appendectomy was done at the Woman's College

Hospital, June 17, 1913. A double pyosalpinx, chronic appendicitis and extensive adhesions were found. No drainage used. Patient left the hospital on the eighteenth day and at the present writing (September 27, 1913) she has returned to her work.

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